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Design and Operation of Hot Gas Producer Plants

By W. S. Mayers*

In the manufacture of glass there is no question of greater importance than that of the design and operation of gas producer plants, the cost of fuel being secondary only to the cost of labor.

In the general design of such plants no definite details of construction may be given, each case requiring different treatment, varying with the location of the furnaces, available ground space for the producers and coal storage and the conveying equipment. Experience has shown, however, that a few general rules may be adhered to which have a very important bearing upon the operation and upkeep of the plant.

In considering the locations of the producers with reference to those of the furnaces it is important that the gas ducts be made short. It is not recommended, however, that the producers be placed as close as possible to the building and adjacent to the furnaces which they supply for the reason that the ducts must have an adequate length and capacity to provide for the deposit of dust which is a constant and troublesome by-product of all producers, especially those mechanically operated. While it is impracticable to prescribe a fixed distance from the producer to the furnace reversing valve, good working conditions may be obtained within the limits of from 50 to 80 feet. The ducts supplying the lehrs will usually be much longer than this, but as the volume of gas passing through them is comparatively small, they are not usually difficult to maintain in working condition. The heavier particles of dust are deposited in the mains nearest to the producers, and it is essential that these mains be made liberal in size in order that the velocity of the gas flow may be low enough to allow the maximum dust deposit. A further reason for large size mains lies in the fact that after a few days' run they become partially clogged with dust, restricting their capacity oftentimes as much as 30 per cent between weekly clean-out periods.

Of no less importance is the provision of ample dust leg capacity, and as a rule not less than three should be located within the first 50 feet from the producer. The first leg will get the heaviest particles, and if properly designed and located close to the producer it will receive more than all the others combined. A design which has been largely and successfully used consists of what is known as the cyclone type, and is a modification of the centrifugal dust collectors in common use. In producer work the cylindrical shells of these dust collectors should be from 8 to 10 feet in diameter with tangential intakes flattened vertically, and with inverted cone hoppers below. The secondary dust legs are preferably made in the shape of flattened funnels with the short diameter at the top equal to the diameter of the main to which they connect. The valves at the bottoms of all dust legs should be from 4 to 6 feet above the ground or floor, and it is probable that the inverted mushroom type, lever operated, is the best that can be designed.

The discharging of dust legs is a messy job at best, and it is almost essential that a dust-tight steel plate or brick enclosure be placed under and around each valve, with bottom doors for removing the dust. In regard to the number of dust legs required, place them close together and make them large, especially near the producers, as they will largely reduce the risk of clogged pipes. The dust legs may be emptied at any time during the week while the plant is in operation.

Another good plan, which has been tried out successfully, consists in making the header elliptical or oval in cross-section and of sufficient capacity to allow the dust deposit of a week's run to accumulate without unduly increasing the gas velocities. This form of header has numerous discharge valves rather closely spaced at the bottom and forms virtually a continuous dust leg.

When more than one producer is connected to a common main header, it is necessary to install sand valves by which any producer can be cut off from the header. A convenient location for these valves is in the short neck between the cyclone collector and the main header above it, but if it is desired to utilize the cyclone for collecting from other producers these valves may be of the vertical type and located in the producer offtakes.

The horizontal type of sand valve, as usually constructed,

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is unsatisfactory and very difficult to operate. A vertical type has recently been developed and marketed which promises to materially lessen the labor and discomfort of operation as well as the cost of up-keep.

In cases where more than one furnace is fed from the producer main sand valves must be placed in each branch to the furnace and lehrs, as the regulating valves can not usually be depended upon to completely shut off the gas to the furnace and lehrs. Clean-out doors of not less than 16 inches clear opening and spaced from 8 to 10 feet apart must be placed on the top or sides of all mains and branches, and it is necessary to provide steel walkways and stairs giving easy access to all clean-out doors and sand valves. Purge stacks are sometimes considered a necessity, but as a substitute one or more clean-out doors may be opened to allow the gas to escape provided that they are not located in a building. Furnace chimneys are usually utilized to provide draft during the clean-out periods, and the connections between the chimneys and the gas mains should be carefully designed. These connections are often too small and should not be less than 36 inches in diameter in the clear, or its equivalent if rectangular in shape.

Underground gas mains and branches are frequently used in some of the older installations, but their use should be avoided where it is at all practicable to install the overhead steel type. It is usually out of the question to construct and operate dust legs in underground mains, and cases have been known where defective water drainage has impaired their usefulness.

In lining steel mains and branches the best practice consists of the placing of heat-insulating brick from 2 to 3 inches thick next to the steel and an inner lining of 4½ inches of good refractory brick. It is recommended as good practice to construct steel mains of from 84 to 100 inches diameter of 5/16-inch plate, 48 to 84 inches of ¼-inch and under 48 inches of 3/16-inch plate. Lighter plates are often used, but it is questionable as to whether the saving in cost balances the disadvantages of shortened life and reduced strength.

Producers

The selection of the producer to be installed must be determined largely upon the furnace requirements, available locations, the kind of coal to be used and the first cost.

A number of plants for the manufacture of cleaned gas from bituminous coal have been constructed for glass factories and other industries, but such plants have not, as yet, come into general use. Washed gas approaches more nearly to natural gas, the ideal fuel, but it is at best but a poor second to nature's production.

By it the dust question is practically eliminated, but the lesser evil of tar is introduced unless expensive equipment for detarring is installed. The sensible heat from the combustion in the producer is lost in the washing process, and this is no small matter, although arguments have been made and theories advanced that the sensible heat thus lost is of no particular consequence in regenerative furnaces. In support of this argument, it is well to observe that there is really but little heat conservation in the regeneration of raw producer gas, which often reaches the checkers at 1,600° F. or more, while the mean temperature of the checkers through which it passes can be scarcely above this temperature.

Passing on to other types of producers we have the old hand-poked variety, excellent gas makers but too slow in action for modern requirements, and the several designs of those mechanically fed and accelerated. While it is not within the province of this paper to express a preference for any particular design of mechanical producer, it is not too much to say that no one of them combines all the points of excellence that could be desired. Improvements have been made in mechanical producers during recent years, and as they all operate upon the same general principles, which may be considered as having been standardized, the prospective purchaser should have no hesitation in buying what the market offers. Improvements will continue to be made in details of construction, but there need be no fear that producers purchased today will be obsolete within the next 8 or 10 years.

In the general layout of plants where the producers may all be placed in a single battery it is not at all advisable to take the entire output of all the producers from either end of the header line as this would either cause undesirable high velocities at the take-off end, or would necessitate the construction of a header with increasing diameters at each producer with one abnormally large section at the distributing point. When the conditions will permit, it is better practice to so locate the producers that the distributing mains may be spaced with as much uniformity as possible along the header. In localities where a dependable supply of natural gas is not available it is most important that a spare producer be installed in order to insure against forced shut-downs. Without such spare equipment it goes without saying that the inevitable shut-downs for repairs are very likely to result in much greater financial losses than the cost of the extra equipment.

Coal and Ash Handling

With all mechanically operated producers it is usually expedient and economical to provide mechanical means for handling the coal, and for the ashes as well, when more than one producer is installed.

Coal handling systems may be divided into two general classes, one of which includes telpher systems with clamshell buckets and the other embracing the different designs of continuous carriers such as bucket elevators and apron, V bucket and belt conveyors.

Where producer plants are located at long distances from the coal fields, involving the use of yard storage, the telpher systems meet the requirements better perhaps than any others. In telpher layouts the coal must first be discharged from the railroad car into a track hopper; then over a feeder into a crusher and finally into a bucket elevator or skip hoist which deposits the coal where it can be reached by the telpher bucket. From this point the telpher conveys the coal either to the yard storage pile or direct to the bins over the producers.

In addition to its adaptability for yard storage the main point of advantage claimed for the telpher system is that it is very flexible, allowing the selection of coal from any part of the yard to be carried to any particular producer

and even for taking coal from one bin and depositing it in another, which might be necessary in case of spontaneous combustion.

In comparison with other systems the telpher has some disadvantages, the first and principal one being that it is considerably higher in first cost. Other disadvantages are that it requires a considerable amount of skill on the part of the operator to prevent mishaps.

The continuous carrier systems, as applied to producer work, may be classified in three different types as follows:

When the producer plant must be separated into two or more batteries one elevator may discharge into two or more belt conveyors leading to each battery, fulfilling a condition which is not always feasible with other types. A layout of this description is shown in the photo-engraving, Fig. 1, where one producer is set at an elevation of 25 feet above the other and 350 feet from it. Two additional producers are now under way for the lower plant, and these additions will mean simply that the belt conveyor will be extended and a movable tripper installed to take care of them.

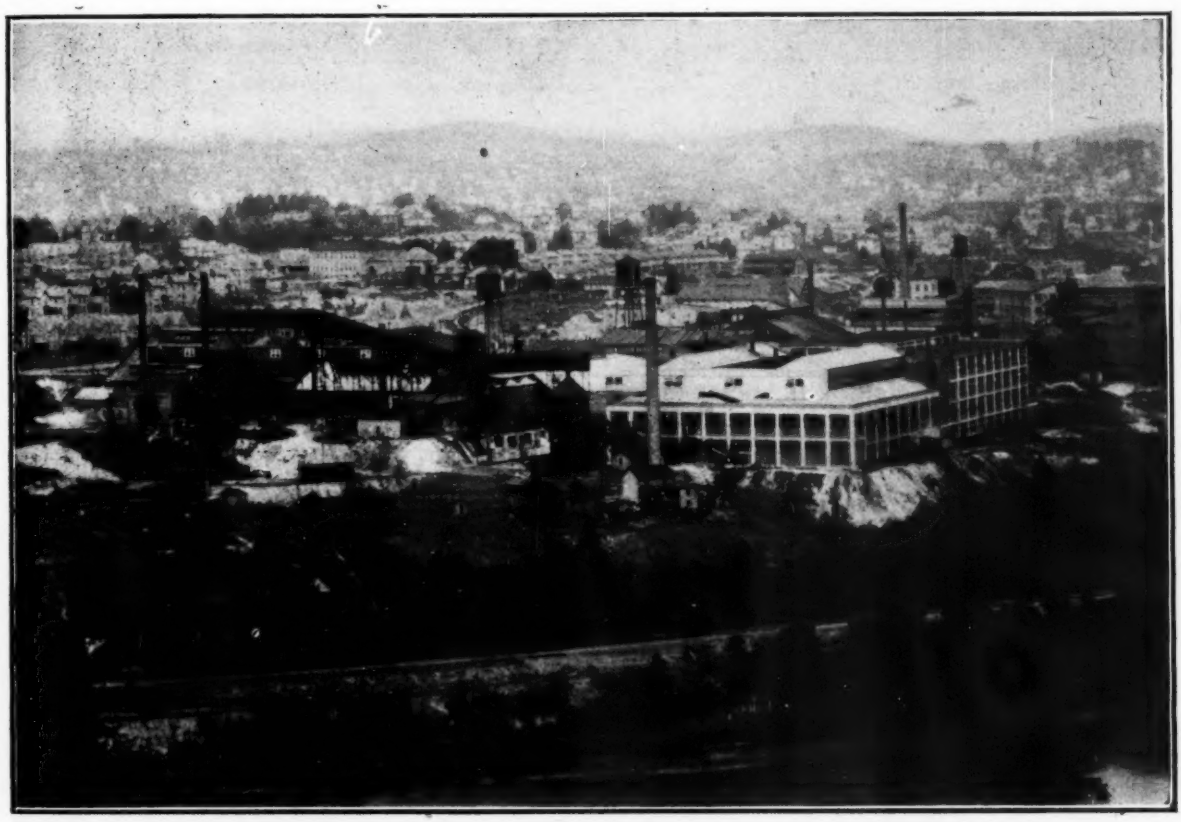

FIG. 1—GENERAL VIEW OF A WEST VIRGINIA GLASS MANUFACTURING PLANT

Showing two separate gas producers, one set at an elevation of 25 feet above the other and 350 feet from it, both served with coal by a single elevator. Just behind the coal conveyor is Factory No. 1. At the extreme left end is Factory No. 3; close by it is the upper producer, power house and reservoir. Below the reservoir, near the junction of the steam and electric railroads, are fuel oil storage tanks. No. 6 Factory is shown prominently near the center of the picture and partly hidden behind it is Factory No. 2. Adjoining Factory No. 6 at the right is Warehouse No. 6. The lower producer and batch bins are shown near the center of the picture. In the foreground is the Monongahela River and the Baltimore & Ohio Railroad tracks.

the bucket elevator in combination with distributing conveyors, the V bucket elevator and conveyors and the pivoted bucket carrier systems.

Each of these types requires the track hopper, feeder and crusher as above described in connection with the telpher system.

For plants not too remote from the coal supply the writer has no hesitation in recommending the first of the three types of continuous carriers above named. Better equipment than the belt conveyor for carrying bulk material has not yet been devised, and if the bucket elevator is sometimes disabled the same thing may happen to both the telpher and the V bucket systems. In any case the storage bin should carry enough coal to cover any ordinary period of shutdown for emergency repairs or other purposes.

The V bucket carrier has points in its favor in regard to simplicity, as the same chains and buckets both elevate and convey the coal, the buckets serving as scrapers in the conveyor trough. It is not so well adopted for long runs as is the belt conveyor type.

The pivoted bucket carrier has been installed in a very large number of boiler plants, but has, as yet, not found much favor in producer work. A large glass factory in the Middle West has had a conveyor of this type in successful operation in its producer plant for several years, and there are perhaps others. The virtues of this type lie in the fact that it handles both the coal and the ashes, and is very economical in power consumption and up-keep.

The mechanical handling of ashes and dust from producers carries with it the necessity of constructing a con-

tinuous tunnel under the ash hoppers which have gates at their bottoms.

No type of conveyor other than the pivoted bucket is suitable for handling ashes from producers on account of the grit and large quantities of water.

In plants which have or may have more than one producer ash tunnels will usually cut down the cost of labor to a degree justifying their construction. In level ground an elevator or skip hoist at one end of the tunnel will be necessary unless either the telpher or pivoted bucket system is used. In case that no storage space for ashes is available they must be elevated and discharged into a bin, preferably of reinforced concrete, directly over a railroad siding, with proper facilities for loading open cars.

In many places ashes may be given away or even sold and hauled away in motor trucks for use in road construction in rural districts. This will require a small storage yard with equipment for conveying the ashes thereto and easily accessible for motor trucks. The mixing of flue dust with the ashes is convenient and customary, but this mixture is of less value than pure ashes for road construction and other uses.

Coal Storage Bins

In the construction of bins the prevailing practice is to build them of steel plate, rectangular in shape, and completely housed in structural steel buildings, with a separate bin for and over each producer.

In recent years some have been made cylindrical in shape with hopper bottoms, and with water-tight steel plate covers. It is well known that cylindrical bins, for given capacities, possess greater structural advantage and cost less than do those of the rectangular type. The huge batteries of grain bins in the Middle West are almost invariably cylindrical in form.

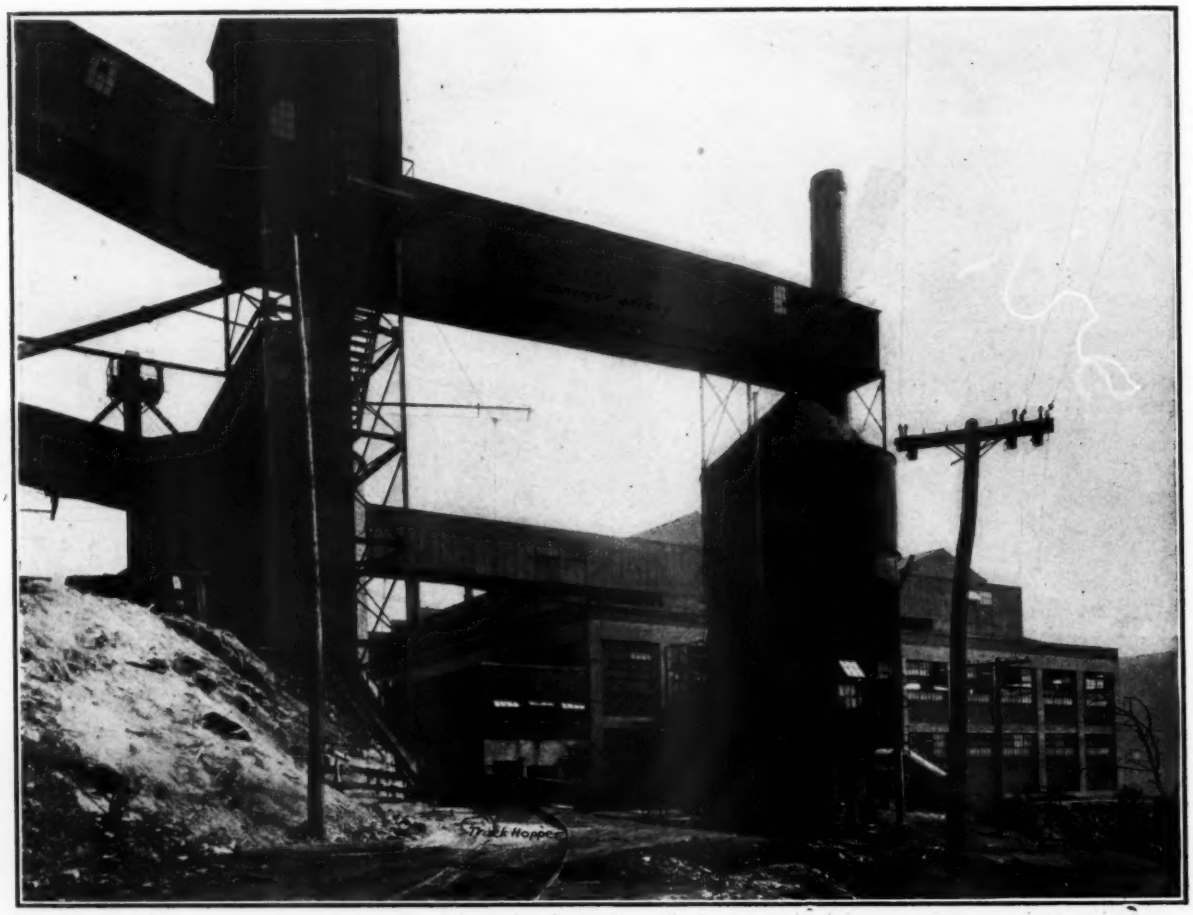

FIG. 2—THE LOWER PRODUCER
Showing track hopper, coal elevator, belt conveyor gallery and, in the background, the batch bins and conveyor galleries.

An argument in favor of the rectangular bins is that they better utilize the space in a rectangular building. But why is it necessary to enclose them in a building when, with water shedding covers, they are just as weatherproof as the building itself, if not more so? The operating room at the tops of the producers and under the main bodies of cylindrical bins may be enclosed at a comparatively small expense, leaving ample room for every requirement in operation.

In Figs. 1 and 2 are shown an installation with steel

cylindrical bins of this description, and since the photograph was taken, two more units have progressed as far as the foundations, with contracts placed for the superstructure. These bins each have capacities of 250 tons of coal and are supported by six H columns 10″ x 10″ at 49 lbs. per foot. They are 25 feet in diameter and have hopper bottoms with closed connections to the producer feeders. The additional bins are spaced 26′ 2″ on centers, and the centers of the producers are 2′ 10½″ off of the common center line of the bins towards the factory building.

At first sight it may appear that the cylindrical bin is not so well adapted as the rectangular type where more than one producer is installed, or where additional bins are

Except in very severe climates it is not usually necessary nor desirable to enclose the spaces between the foundation and the operating floor. A convenient and comfortable den should, however, be provided for the ash men on the ground floor for use during the winter months.

In plants using such producers as those of R. D. Wood & Company and The United States Cast Iron Pipe Company, it is essential that jib cranes or I beam trolleys with chain blocks be constructed for handling the heavy stirrer bars when renewals are made. Certain sections of the steel operating floor within reach of the chain block are made removable so that the stirrer bars or other heavy parts may be easily elevated into the operating room through the floor

FIG. 3—ANOTHER VIEW OF THE LOWER PRODUCER PLANT
To which two more units are now being added.

to be added from time to time. Such, however, is not the case. Referring to Fig. 1 the two hexagonal sides of the enclosure will be split on the center line at the nearest column shown in the picture and swing 60° outward so that they are parallel with the center line. The triangular spaces between adjacent bins are floored over and roofed, thus making a continuous operating room over all the producers.

The cylindrical bin walls extend 48″ below the top of the hoppers, which allows the corrugated metal siding to extend a short distance upward into the space between the hoppers and wall extensions. This effectually keeps out the rain and provides vents for escaping gas from the poke holes.

openings. Steel sash with top hung ventilating sections are to be recommended in this type of construction.

Producer Operation

This is a subject in relation to which it is not practicable to carry out a set of hard and fast rules or methods on account of the variability of the working conditions.

The quality of the raw fuel is by all odds the most important factor in producer operation, and with low grade coal it is often difficult to get satisfactory results in the best designed plants.

A few producers using anthracite coal are still in existence and are, as a rule, much easier to operate than those

using bituminous coal. The cost of anthracite, however, has advanced much more rapidly than the cost of bituminous coals during recent years, and only in rare instances is the use of hard coal for gas making justifiable.

The ideal bituminous coal for producers analyzes approximately as follows: moisture 3.5, volatile matter 35.0, fixed carbon 56.0, and ash 5.5. Low sulphur non-caking coals with ash of high fusing temperature are desirable.

The large lumps in run of mine coal must be crushed to sizes under 3 inches maximum dimension, and it is generally held that the fuel bed is much less liable to pack if the fines under ½ inch are screened out.

The depth of the ash, combustion and green coal zones in the producer depends upon the quality of coal used, the size of the producer and the rate of gasification desired, and is best determined by actual practice. When coals of different grades are mixed promiscuously, it is very difficult to maintain uniformity of operation.

Low grade coals, especially those with high contents of clinker forming ash, require high temperatures in the combustion zone, with a resulting high gas temperature and an excess of CO_2.

The proportion of air and steam in the blast must remain constant for all loads to produce a gas of uniform quality, and automatic regulation in this respect has been successfully used during recent years. In the absence of automatic regulation, the customary practice is to maintain a constant temperature of the combined steam and air blast as shown by indicating or recording thermometers. This method takes into account neither the temperature nor the relative humidity of the air, and affords no indication whatever of the amount of air and steam entering the producer. The producer operator rarely has sufficient technical knowledge to enable him to determine the steam and air ratings required under varying conditions, and his only guide is usually the fluctuation of temperatures in the furnaces using the gas. This is obviously a costly method, and it calls for either high class and highly paid operatives or the installation of effective automatic controlling apparatus.

With low grade fuel it is not unusual to find gas temperatures reaching 2,000° F. With such temperatures it is apparent that the gas regenerators at the furnaces have little effect except to retard the flow of the gas. Excessively hot gas has a very destructive effect upon metal with which it comes in contact, and the writer knows of cases of high temperatures where the mushroom valve and stem at the gas reversing valve last only from 3 to 4 months.

During burn-out periods it is important that mushroom valves and sand dampers be looked after in order that they may not be damaged by excessive heat developed locally by air currents. The mushrooms at the reversing valves should be closed and the pyrometer couples withdrawn during burn-outs.

Jet blowers and steam turbine driven fans for producing the blast are in general use and possess the advantage that variations in the steam flow produce corresponding variations in the air flow, this being a very important feature. To get the correct proportion in air and steam mixture it is necessary that rather high steam pressure be used, this pressure depending upon operating conditions. With low pressure steam the amount of steam required to produce the proper amount of air will be excessive and wasteful. As the efficiency of both the small steam turbine and the jet blower in producing air supply are very low, the writer suggests that the steam and air supply may be independently regulated, and with better economy, by placing an electric motor-driven fan with variable speed in series with the turbine-driven fan or jet blower. By this arrangement low pressure or even exhaust steam from external sources may furnish the necessary moisture, the motor-driven fan furnishing the air. If exhaust steam is available the pipe is connected directly to the producer blast pipe with the turbine or jet blower sealed off, the air being supplied by the motor-driven fan.

Leaky automatic feeders are a source of much discomfort and waste of gas, and certain designs as now furnished are much in need of improvements. The supposed danger of firing the coal in the bins through the feeders does not exist.

There is, however, always a possibility of its firing by spontaneous combustion, and under certain conditions the possibility becomes a certainty. With a bin full, or nearly full, of coal high in ash and sulphur, and containing a large amount of slack and dust, spontaneous combustion is very likely to develop in case the producer is not operated for a period of from 4 to 6 months.

As an example, the upper producer shown in the accompanying illustration was shut down last year, 1923, for an indeterminate period. The bin was about two-thirds full of run-of-mine with a large proportion of slack rather high in ash and sulphur. About 5 months after the shut-down spontaneous combustion was evidenced by smoke from the intake at the top of the bin. Consultation with the fire department and other sources of information was to the effect that it is very difficult, if not impossible, to quench fires in stored coal by flooding with water, and that the only resource was to remove the coal from the bin.

As this would have been a rather expensive means it was decided to try the water cure. A stream from a fire hose was accordingly directed into the bin above the coal. There was naturally considerable leakage through the feeder, but on account of the fine coal this was much less than the expected amount, and no difficulty was experienced in keeping the water level near the top of the coal. After about two days' flooding, during which time considerable smoke and some steam emerged from the bin intake, the fire was effectually quenched with little or no damage to the bin and producer.

Some months later another unexpected shut-down at this same producer occurred, this time the bin being full with 250 tons of the same grade of coal. In about 6 months after the shut-down the inevitable spontaneous combustion again appeared. It was decided in this case to resort to other methods of quenching the fire, the first being to inject the gas from several quarts of liquid carbon dioxide through a small pipe forced from the bottom of the bin into the coal mass. Steam was then, by the same means, blown into the coal. As evidenced by the emitted smoke neither of

these methods produced pronounced results, so the water method was again tried and again proved successful. In this case the coal was heaped up into the conical bin covering, and it was found advisable to remove from 75 to 100 tons. This was accomplished without any handling by hand or power. Upon opening the inspection door just above the feeder the coal and water mixture flowed like concrete, and was spouted to the ground under and alongside the bin structure.

These experiences indicate that there is no great cause for alarm upon the appearance of fire in bins of this description, always remembering that a bushel or two of soft coal will produce a great deal of smoke when fired slowly.

In bins of this design it is to be recommended that a 2½-inch pipe from 18 to 25 feet long be suspended at or near the vertical axis, this pipe to be closed at the bottom and to have numerous small perforations at the lower half. There is thus provided a means for ascertaining the temperature of the coal at any time and for conveniently flooding the center of the coal mass.

These fires are of unusual occurrence, and are preventable by emptying the bin previous to a prolonged shut-down, and there need be no worry on this account as long as the producers are operated even a few days each month.

Rated Capacities of Pot Furnaces and Tanks

An Interesting Discussion of the Topic and a Suggestion for a Uniform System of Rating

By E. W. Koering

From time to time questions of a more or less general nature arise pertaining to glass manufacture. The subject of uniform classifications and ratings for glass tanks and pot furnaces has been discussed at various times. It is obvious that the proper rating should give an idea of the size of the tank or furnace in question as well as the daily output.

Pot furnaces are generally designated by the number of pots regardless of the pot capacity. One pot to each arch being the common practice. For example, a 6, 10 or 16 pot furnace has six, ten or sixteen arches respectively. In New Jersey, furnaces of circular cross section are the rule and covered pots are used exclusively. A furnace of this type may have one narrow arch and all the others full sized, the narrow arch being about 0.6 the width of the others. Thus a furnace having six wide arches and one narrow one would, among glass workers, be designated as six pots and a "monkey." A monkey being a narrow pot having nearly the same length and metal line as a large one. If for any reason the last mentioned furnace were equipped altogether with monkey pots as is sometimes done in actual practice, it would be possible to put two pots in each of the large arches and one in the monkey arch making thirteen in all, but it would still be a seven pot furnace, or more correctly, six pots and a monkey.

From the foregoing it is apparent that the capacities of two furnaces of an equal number of pots may differ widely through the use of different sized pots. In fact the capacity may vary in the same furnace at different periods. An example from practice in connection with a 9 pot furnace will make this clear. When the furnace is newly repaired the bench will comfortably accommodate a setting of pots 48 inches wide, 52 inches high, and 68 inches long. After two or three months' operation it will be found, when setting a new pot to replace a broken one, that the bench adjacent to the eye has been considerably eroded necessitating the use of a shorter pot, thus reducing the capacity of the furnace. This erosion of the bench or burning out of the eye will continue throughout the "fire" until the efficiency of the furnace is reduced to such an extent that the fire must be let out and the furnace repaired. Formerly the duration of a fire was about ten to eleven months, repairs being made during July and August, except in cases of emergency. The present custom, however, is to run a tank or furnace until it gives out, regardless of the season of the year, the longer the fire the better because it helps cut down the cost of production.

After all is said and done, it is more than likely that a twelve pot furnace will continue to be called a twelve pot furnace whether the capacity of a pot is 500 or 3,000 pounds.

In the classification of tanks the tendency is towards rating them on the daily output rather than on total or dead weight capacity.

However, this method of rating is by no means general. One and the same tank working three shifts may be designated as a 300 ton, 60 ton, 8 ring, or 24 blower tank according to whether reference is made to total capacity, daily output, number of gathering holes, or number of blowers. In some cases, where small lumps of glass are worked the ringholes and rings are replaced by "boots." It is entirely possible for a well designed and efficiently operated 200 ton continuous tank to deliver more glass than a poorly designed and inefficiently operated tank of 250 tons total capacity. Since the ratio of daily output to total capacity is not a constant quantity the mention of just one of the factors does not tell the whole story. Of the two, the daily output is the more important. On the other hand, first cost, fuel consumption and cost of repairs are contingent upon the size of the tank and must not be overlooked. The ratio of daily output to total capacity gives information as to the efficiency of the unit and in these days of close competition it is efficiency that counts. In this connection it may not be a bad idea to borrow an expression used in the automobile industry to rate gasoline motors, namely: 4-20 or 6-60 to designate 4 cylinder 20 horsepower and 6 cylinder 60 horse power motors respectively.

Applying the same formula, a continuous tank may be rated as a 20-80 ton or 60-300 ton to denote tanks of 20 tons daily output and 80 tons total capacity, or 60 tons daily output and 300 tons total capacity respectively. In like manner, a pot furnace could be rated by stating the number of pots and daily output in tons. This rating would at least give a clue to the size, cost and efficiency of the unit.

Day tanks are rated according to daily output or total capacity and in case of small ones of one to four tons which are worked out to within a few inches of the bottom either rating is close enough for all practical purposes.

The Principles and Practice of Annealing Glassware

By S. R. Scholes*

From the earliest years of the art of glassmaking, the necessity for "tempering" pieces of ware, so that they shall not fly in pieces in use, has been recognized. Therefore the nature and origin of strains in glass have been made the subject of much study and are quite thoroughly understood.

These strains generally consist in compression on the surfaces, and tension in the interior of the piece. They arise from the unequal rates of cooling as between surface and interior because of the poor heat conductivity of glass. The exposed surfaces cool first, and while the interior is still plastic, the surfaces become rigid. Further cooling of the interior, with consequent tendency to contract, produces tension in the interior which remains after the entire body has become rigid, and is opposed by compression in the exterior portions. In the case of relatively small hollow ware, the inner surfaces, protected from rapid cooling by radiation, may also be in tension as opposed to the outer surfaces. Hence the ease with which unannealed pieces of hollow ware may be broken, sometimes exploded, by dropping into them pieces of sharp glass, thus rupturing the surfaces and permitting the strains to tear the pieces apart.

The removal or prevention of these strains is accomplished by maintaining the ware for a brief time at a temperature above what is known as the lower critical temperature (where the glass becomes actually rigid), then cooling it slowly until the lower critical temperature is passed. The rate of cooling depends upon the thickness of the ware and the amount of strain permissible in the finished article. That is, thin blown ware, where no heavy bottoms are present, may be cooled more rapidly than heavy ware or pieces having thick and thin portions. Also, it is obviously unnecessary to remove the strains from a drinking glass as thoroughly as from a piece of optical glass.

The modern device for annealing glassware is the automatic muffle lehr, which supersedes the open, pan lehr, the successor to the kiln of former days. The lehr serves a useful incidental purpose, in addition to tempering glass, in acting as a conveyor between factory and sorting room, and thus supplying a place of storage for the ware until it is cool enough to be handled. Therefore the length of these lehrs is greater than would be absolutely necessary if the annealing of glass were the only function performed; and as it will be shown later, an exaggerated idea of the length of time given to annealing is acquired by considering the entire period of travel through the lehr.

That the lehr is at best only a rough means of annealing glassware, becomes apparent when the circumstances under which it operates are mentioned. To begin with, the ware arrives at the lehr in various states as regards temperature, weight, and thickness. Some pieces are sufficiently hot and heavy to anneal themselves, if they could be at once heat-insulated and allowed a couple of hours to cool. Others are hot in their thickest portions, but below the lower critical temperature in thinner portions, while all sorts of light-blown ware arrive at the lehr chilled to rigidity. The lehr must often receive a mixture of these three classes, supply heat enough to the cooler ware to relieve the strains while still not overheating the already hot ware, and then accomplish a regulated cooling that will bring out all these dissimilar articles practically free from strain.

Besides encountering these variations in the condition of the ware with which it is charged, the lehr is subject to drafts of cold air whenever a door is opened to admit ware, and it is a very difficult matter to maintain a chosen temperature gradient in the face of fluctuating wind and weather conditions.

But in spite of these obstacles to its perfect functioning, the lehr is effective, and when properly handled, will turn out a well-annealed product.

The conditions in its favor are (1) the fact that glassware can be heated well above its critical temperature for a short time without deformation and (2) fine annealing, such as optical glass undergoes, is not required of it, and the removal of approximately 90 per cent of the strains in the glass suffice for any ordinary ware.

The vital element in lehr control is the temperature gradient, or fall of temperature relative to time of travel. Modern muffle lehrs are so designed as to permit a gradation of temperatures in the fire-box itself. That is, a higher heat can be maintained at the front, where the ware enters the lehr, and lower temperatures toward the back. The measurement of these temperatures is by no means easy, if exactness is required. For one thing, the thermocouple must be up out of the way, and as a rule the lehr atmosphere is from 50 to 100 deg. F. hotter near the crown than it is near the pans. A pyrometer reading 1,000 deg. F., therefore, may mean barely 900 deg. F. at the pan-level. Thus it is necessary to establish a working range of temperatures as indicated by pyrometers, which will be peculiar not only to each lehr, but to each kind of ware the lehr handles, to the rate of travel, and of course to the nature of the glass.

The first twenty feet or less of the average lehr forms the zone where annealing is accomplished. After passing this far, and cooling approximately 100 deg. from the high point reached, ware can be removed and cooled rapidly in the air, without developing more strain than it would have in case it made the entire journey, the full length of the lehr. The remaining portion of the lehr is essentially only a conveyor, carrying the ware back and taking care of it until it is cool enough to be handled.

However, there is one important function, or rather consequence, of the long tunnel constituting the back two-thirds of the lehr. By reason of its length and the fact that it is largely filled with ware, it minimizes the drafts and air currents that might otherwise upset the temperature gradient and prematurely chill the ware. To build this portion entirely of brick, as it is often built, is obviously wasteful construction. Some lehrs are so solidly built, and therefore so well insulated against heat loss in the back portion, that some ware comes off too hot for comfortable handling. In such

*Chief Chemist, The Federal Glass Company, Columbus, Ohio.

a case the top of the lehr can be removed, for ten to twenty feet from the back end, thus permitting better cooling, without lessening the efficacy of the lehr.

The measurement of lehr temperatures has already been referred to. The proper installation of thermocouples and the adjustment of instruments are matters for electricians and pyrometer engineers. Needless to say, these must know their business and pyrometer equipment must be correctly set up, or deceptive readings will result, which may be worse than useless. Good pyrometers are now available from several sources, and there is no excuse for relying on the lehr-tender's eye or the time-honored wad of paper, to ascertain the proper temperature. Where it is feasible, two or more thermocouples should be installed, one near the front of the muffle or firebox, another four or five feet back, and others farther back if it seems necessary, in order to control the temperature gradient.

It is a fallacy to conclude that when the ware is not properly annealed, the lehr is not hot enough; it is quite possible to get lehr-melts and poor annealing together. If ware is put into a lehr where the fire-box temperature, sustained for ten feet or so, is sufficient to deform the ware, and then is moved abruptly from this hot zone into a temperature a hundred degrees cooler, strains will certainly be set up. Higher firing will only aggravate the difficulty, and the remedy is to moderate the heat, at the same time graduating the temperature with the movement of the ware so that the first hundred degrees of cooling are passed regularly and slowly. If heat alone could anneal glass, the lehr would be unnecessary, for the ware has already been hot. The rate of cooling from a temperature high enough for the strains to be relieved is the essential factor.

In theory at least, modern muffle lehrs are designed to heat the pans as hot as the atmosphere surrounding the ware. In practice it is often difficult to obtain this evenness of heat distribution, and it then becomes necessary to put in auxiliary burners which will heat the pans. This is especially true when ware is being charged which has cooled since leaving the mold to such an extent that much heat must be supplied, notably in the bottoms.

The final criterion of lehr operation is freedom from strain in the ware. This is best determined by examination by polarized light. Glass having internal strain is not optically homogeneous, and therefore distorts plane-polarized light in its passage through the strained article. Viewed through the "analyzer" of a polarized light apparatus, the otherwise dark field from the "polarizer" will show streaks or spots where strained glass is interposed. These streaks vary from a faint blue to strong spectral hues, depending on the intensity of strain. These "strain-finders," "sclero-scopes," or varieties of polarized light apparatus, are so easily obtained and so simple to use that no glass factory should be without one, as a constant check on the performance of the lehrs. Good annealing demands close attention.

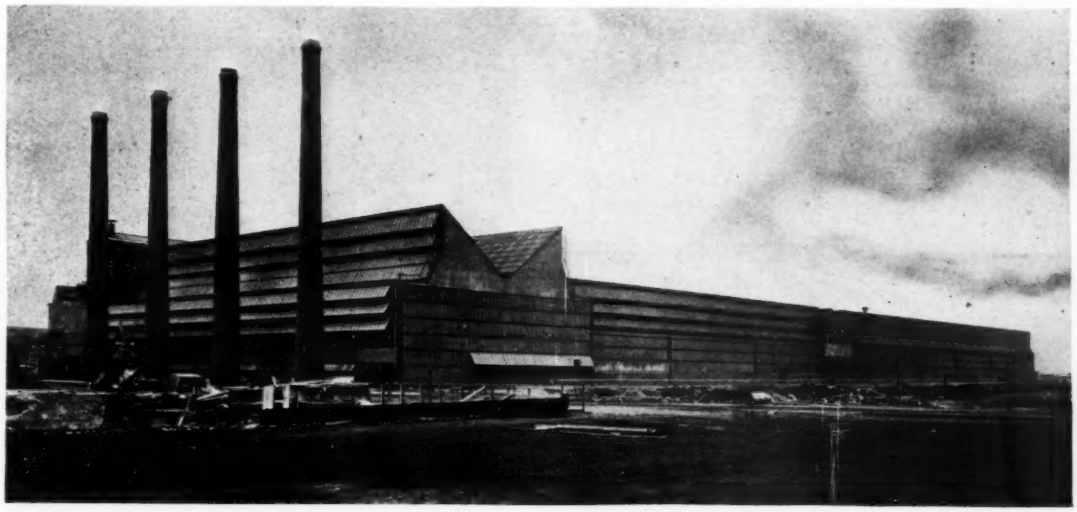

Plate Glass Manufacturing Plant of the Ford Motor Company at River Rouge

This enormous building, 760 feet long and 240 feet wide, houses four distinct and complete units for producing automobile glass by the Ford continuous flow method, a revolutionary process developed by the Ford engineering staff at the Company's glassworks at Highland Park, Detroit.

Each unit consists of a glass melting furnace of about 400 tons holding capacity, an annealing lehr 442 feet long, 86 grinding machines and 72 polishing machines. The combined production capacity of the four units is about 10,000,000 square feet of polished plate glass per annum.

The building was designed by Albert Kahn, architect, and the engineering department of the Ford Motor Company, The general contractor was Everett Winters Company, Detroit.

Before the construction of the River Rouge works the Ford process had been thoroughly worked out on a commercial scale at the Highland Park plant which began operations in 1922 and has an annual capacity of about 1,250,000 square feet of polished plate glass.

The River Rouge plant was described in detail in THE GLASS INDUSTRY of July, 1924. The Highland Park equipment and operations were described and illustrated in the issue of January, 1923.

The Ford Motor Company also owns the factory at Glassmere, Pa., formerly operated by the Allegheny Plate Glass Company where plate glass is manufactured by the older, standard method of casting the plates from pots.

On Devitrification Phenomena in Practice in Glass Factory Operation*

By Hugo Knoblauch

(Continued from December Issue)

In Fig. 12 a further proof can be advanced that glass in the fused condition may hold Glauber's salt, or what is the same thing, glass galls in solution which it separates out under the conditions for devitrification. The elliptical complexities evident in the illustration seem to be bubbles; in reality, however, they are not, for there are no cavities as we see them in iron bubbles, in ordinary gall bubbles or chiefly in gas bubbles. It is a case here of segregations without cavities, the spots occurring in very different sizes show an extremely delicate slightly iridescent structure and are permeated with an infinite number of the finest cracks. The latter according to the opinion of the author are due to the increase in density of the first liquid glass galls. It is to be remarked here especially that these segregations show only

FIG. 12

if the decreased temperatures restricting devitrification are present; on this basis they also occur ordinarily together with blowy and rough glasses and disappear completely at a sufficiently high working temperature.

Such gall segregations, which are ordinarily called gall stones and which appear in the glass on account of the lack of sufficient fusion are represented chiefly as cavities partially filled with solidified Glauber's salt and always remain mechanically distributed in the glass if they are once present, they cannot be made to disappear by increasing the furnace heat.

On the other hand we can produce or remove segregations like those in Fig. 12 at our convenience according to whether the furnace heat falls or rises, provided of course, that the glass flux contains dissolved Glauber's salt. According to the observations of the author such segregations show chiefly when a glass is melted too rich in alkalies; in the foregoing case with too great an addition of Glauber's salt.

It is asserted many times that such segregations are caused especially by a large sulphur content of the heating gases; this is disputed by the author on the ground that these spots always show very strongly as soon as the temperature goes down, and they disappear, on the other hand, as soon as a strong heat acts on the glass flux.

If the sulphur content of the gas were the cause of these segregations, they would disappear if little gas is burned, and appear when much fire acts on the glass. Fig. 13 shows three microphotographs of these spots illustrated in Fig. 12 and the crystallographic-optical characteristic of these samples indicates that it has to do with Glauberite segregations.

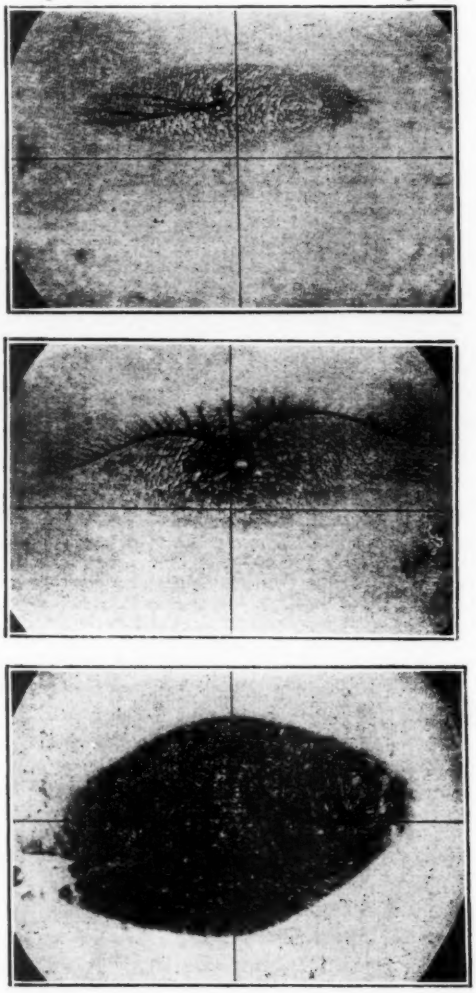

FIG. 13

Glauberite consists of sodium sulphate and calcium sulphate in molecular proportion.

The author has already reported in detail in *Sprechsaal* on the separating out of Glauber's salt and the real gall stones. Segregations of individual constituents of the glass mass occur further in the manufacture of chrome and copper aventurine glasses which show the phenomenon clearly.

With glasses that on working are handled a rather long time while hot or must be worked within a temperature

*Sprechsaal, Vol. 57. May 23, 1924. Translated for THE GLASS INDUSTRY.

range lying very near the devitrification temperature, the tendency to crystallize makes itself very unpleasantly felt. This happens principally in the working of the Thuringian tubing glass in the blast lamp. On attaching small pieces, or on melting and blowing the glass, more or less coarse parts frequently appear, from which the attached pieces crack off very easily. This evil condition can be prevented somewhat by the addition of some alumina to the glass flux.

In Fig. 14 we see a piece of glass almost natural size which comes from rolled ribbed glass. When rolled window glass is to be ribbed the previously worked lot of glass is first suitably warmed in the drum furnace and blown in the mold. Thus the glass is handled longer than usual in the drum fire, it is therefore a correspondingly long time in a state of temperature which is not sufficient to soften the glass completely, but it is also insufficient to let the mass

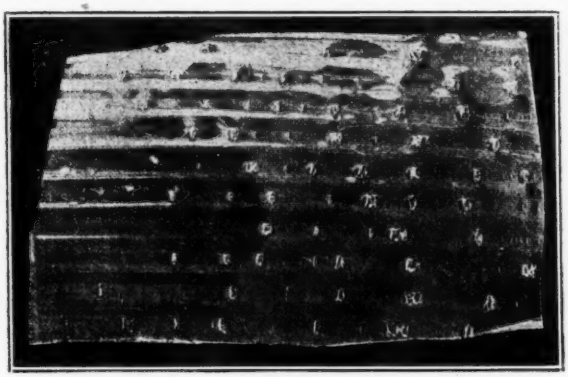

FIG. 14

become completely stiff. This condition may last two to three minutes and this sufficed in the foregoing case to let segregations form in a very clear glass; and actually while the glass was on the blowpipe. The illustration permits us to see that these segregations formed in remarkable uniformity in the depressions of the ribs, that is where the glass came into contact with the iron of the mold. These phenomena showed very plainly on the head end of the roll while the rolls towards the sides become clearer and clearer. However, it is especially striking in this sample that all crystallized complexes are surrounded with hollow space which can be seen in the illustration as shining bubbles as a result of reflection phenomena.

In the preparation of medicinal glasses which, as is known, are worked over the nipple, devitrification phenomena are likewise frequently noticeable. "Over the nipple" is used when the glass blower works several pieces on a pipe over the batch first gathered; he therefore does not turn the pipe, therefore does not let the glass break off from the head of the pipe before he takes up new glass, but he works several bottles over the same glass residue adhering to the pipe head. In this case he mixes cold glass adhering to the pipe with the glass newly taken up and the results of this are likewise various fine crystalline segregations, a condition which the glass-maker calls "greasing the nipple." In this case there are more or less turbid coils from the mouthpiece frequently deep into the glass. This method of working is usual in small glasses, however, one always has to reckon with the phenomenon mentioned and the composition of the glass and the method of working must be taken into account.

Figs. 15 and 16 can be included here as very characteristic samples of devitrified brown bottle glass. They correspond essentially to sample 6; in Fig. 15 a quantity of spherulites of great uniformity and complete form are piled

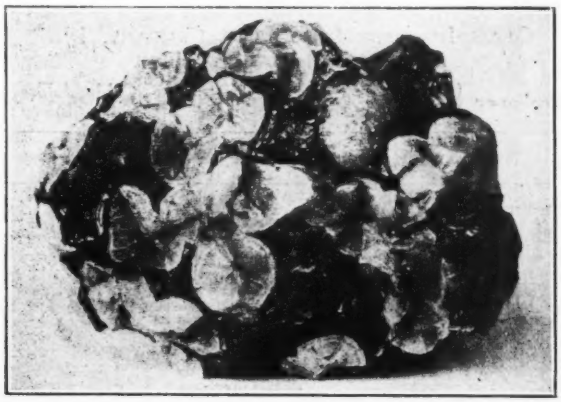

FIG. 15

on one another, while the intervening spaces are still filled with the amorphous mother-substance.

In Fig. 16 a spherulite of rare size and uniformity is shown; it is a twin spherulite about 950 g. in weight, whose large axis is about 110 and the small axis about 70 mm.

In the large example which likewise formed in a glass colored with pyrolusite it is worthy of note that the surrounding mother-liquor had no violet coloring, while the

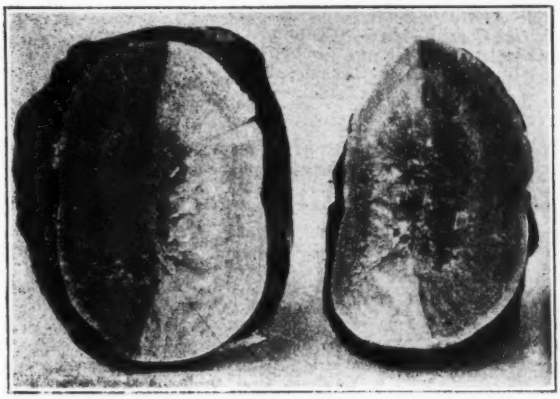

FIG. 16

outer ring of the spherulite showed plainly the violet color of the manganese superoxide.

Excepting the clouded glasses which mostly serve for decorative purposes, hardly a case is known in which one has made use of the devitrification tendency of the glass. We desire to mention the so-called Garchey stone here.

It is a method according to which different glass dust mixtures are pressed in molds, heated to the softening temperature and thus are changed to a half crystallized, half sintered condition. This product is used mostly in the form of floor and wall lining slabs, but it seems, doubtless as a result of the expensive and bothersome method of manufacture, not to have come on the market as desired.

The Glass Industry

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CONTENTS

	Page
Design and Operation of Hot Gas Producer Plants	1
Rated Capacities of Pot Furnaces and Tanks	7
The Principles and Practice of Annealing Glassware	8
Ford Motor Company: River Rouge Plate Glass Manufacturing Plant	9
On Devitrification Phenomena in Practice in Glass Factory Operation (Concluded)	10
Editorial: The Industrial Outlook	12
Technical Consultation Service: Calculation of Glass from Batch Composition	12
1923 Census of Secondary Glass Industries	13
New Books: Chemistry in Industry	13
Old Glass	13
Recent Patents	14
Glass Factory Equipment and Supplies: New Type of Sand Valve	16
The Glass World and What It Is Doing: Libbey-Owens Reports Very Profitable Year	17
Distributors Hold Successful Meeting	18
Flint and Lime Association Golden Jubilee	19
New Beveling and Mirror List	19
Big Victory for Glass in Rate Decision	19
Trade Activities	20
Coming Meetings	21
Recent Deaths	21
Inquiries Received	21
What the World Wants	21
Stock Quotations	21
Current Prices of Glass Making Materials	22
Monthly Summary of U. S. Foreign Commerce in Glass	22

CLASSIFIED BUYERS' GUIDE, PAGE 20
INDEX TO ADVERTISEMENTS, PAGE 22

A Happy New Year

THE GLASS INDUSTRY takes pleasure in thanking its readers, authors and advertisers for their hearty co-operation during the past year, and wishes them all a Happy and Prosperous New Year.

The Industrial Outlook

The Engineering Advertisers Association of Chicago, composed largely of prominent manufacturers of engineering products, recent completed a survey of the opinion of the leading men in various industries with the object to ascertain the probable production activities during the first six months of 1925. It was not the purpose to elicit generalities with reference to the industrial outlook for the new year. At this season plenty of such information is available, the value of which is somewhat problematical since it is founded largely on faith and hope rather than on fact.

The census was taken with the cooperation of the technical and business press covering the various industries. It was based on the assumption that executives must have definite ideas as to the output of their own plants in the six months' period which has just begun. The result of the survey is of particular interest at the present time of the much heralded boom in the stock market which has inspired a number of utterances of a highly optimistic nature based upon the belief that Wall street never errs in its forecast.

The judgment of the leading manufacturers, as learned from the survey, appears to be that industrial activities will be increased during the new year. In some of the industries expansion promises to be slight. In others, notably the steel and the automotive industries, the prospects are decidedy favorable. The feeling exists that industry has entered upon a period of quiet growth. The uncertainties of the political situation have been removed. A change for the better has taken place in the West through a combination of favorable happenings which have advanced grain prices, in the face of a large harvest. The foreign situation continues to improve. All these factors contribute to brighten the outlook. On the other hand the manufacturing profits in many industries continue low; there is a productive capacity in several lines which is well above domestic consumption. Taxes remain high and are used largely for unproductive purposes. Manufacturing and transportation costs show no signs of decrease. It is difficult to strike the balance between the many conflicting influences. Let us hope that the optimists are right and that 1925 will confirm the expectations of some of the most prominent leaders of industry.

Technical Consultation Service

QUESTION 64. CALCULATION OF GLASS FROM BATCH COMPOSITION. I have been greatly interested in your paper "Some Calculations of Glass Technology" in the July, 1921, issue of THE GLASS INDUSTRY, giving very careful directions for reducing the analysis of the glass batch to the analysis of the finished glass. There are some things, however, which I do not understand, and will be pleased if you will furnish me the information.

In the table of factors given, you have the item of borax twice; one of which is to be multiplied by .366 and the other by .163. Kindly explain the difference between these two and advise which one is generally used by glassmakers.

ANSWER.—The weight of borax multiplied by .366 gives the amount of boric oxide introduced in the batch. The figure .163 gives you the amount of sodium oxide introduced in the batch by this weight of borax. Both figures are used, depending on what is desired to be known.

Instead of crystal borax, the fused borax is used a great deal. In order to calculate the amount of boric oxide introduced by a given weight of fused borax multiply by .692. To get the amount of sodium oxide, multiply by .307. J. B. K.

1923 Census of Secondary Glass Industries

Substantial gains over the year 1921 in the production of mirrors, framed and unframed, and a moderate increase in the total value of products manufactured by glass cutting, staining and ornamenting factories are shown by data issued recently by the Department of Commerce giving the results of the biennial census of 1923 in these industries.

Mirrors

The establishments engaged primarily in the manufacture of mirrors, framed and unframed, reported products valued at $33,507,973, an increase of 100.2 per cent as compared with $16,739,545 in 1921, the last preceding census year.

In addition, mirrors are manufactured to some extent as secondary products by establishments engaged primarily in other industries. The value of the mirrors thus made outside the industry proper in 1921 was $1,053,387, an amount equal to 6.3 per cent of the total value of products reported for the industry as classified. The corresponding value for 1923 has not yet been ascertained but will be shown in the final report of the present census.

Of the 196 establishments reporting for 1923, 49 were located in New York, 18 in Pennsylvania, 17 in California, 15 in Illinois, 11 in Ohio, 9 each in Missouri and New Jersey, 8 in Indiana, 7 in Wisconsin, and the remaining 53 in 21 other States.

The statistics for 1923 and 1921 are summarized in the following statement. The figures for 1923 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

	1923	1921	Per cent of increase
Number of establishments	196	180	8.9
Wage earners (average number)[1]	3,471	2,368	46.6
Maximum month	Feb. 3,512	Dec. 2,616	....
Minimum month	Dec. 3,397	Jan. 2,242	....
Per cent of maximum	96.7	85.7	....
Wages	$4,892,543	$3,232,984	51.3
Cost of materials (including fuel and containers)	20,103,199	10,082,161	99.4
Products, total value	33,507,973	16,739,545	100.2
Mirrors	28,694,562	15,064,053	90.5
Other products[2]	4,813,411	1,675,492	187.3
Value added by manufacture[3]	13,404,774	6,657,384	101.4
Horsepower	5,802	(4)	....
Coal consumed (tons of 2,000 lbs.)	17,617	(4)	....

[1] Not including salaried officers and employes nor proprietors and firm members. Statistics for these classes will be given in final report.
[2] Includes windshields, store fronts, beveled, polished, and silvered glass, art and leaded glass, picture frames, auto glass, novelties, chipped glass, patent fronts, show cases and fixtures, table tops, cabinets, and stained glass.
[3] Total value of products less cost of materials.
[4] Not reported.

Glass Cutting, Staining and Ornamenting

The establishments engaged primarily in glass cutting, staining and ornamenting reported products valued at $25,026,557, an increase of 12.7 per cent as compared with $22,209,476 in 1921, the last preceding census year. The principal classes of work done by establishments included in this industry are glass cutting, glass beveling, bending sheet glass, engraving on glass, making glass labels, and staining or ornamenting glass.

In addition, glass cutting, staining and ornamenting are carried on to some extent by establishments engaged primarily in other industries. The value of the products resulting from such work thus done outside the industry proper in 1921 was $1,053,773, an amount equal to 4.7 per cent of the total value of products reported for the industry as classified. The corresponding value for 1923 has not yet been ascertained, but will be shown in the final reports of the present census.

Of the 434 establishments reporting for 1923, 101 were located in New York, 73 in Pennsylvania, 39 in Illinois, 36 in New Jersey, 28 in Ohio, 25 in California, 23 in Massachusetts, 15 in Missouri, 13 in Minnesota, 10 each in Connecticut and Wisconsin, 8 each in Maryland and West Virginia, and the remaining 45 in 18 other states. In 1921 the industry was represented by 462 establishments, the decrease to 434 in 1923 being the net results of the loss of 73 establishments which reported for 1921 and the inclusion of 45 which had not been classified in this industry for 1921. Of the 73 establishments lost to the industry, 24 had gone out of business before the beginning of 1923, 17 were engaged in other lines of manufacture and were, therefore, transferred to the appropriate industries, 8 were idle, 5 were no longer engaged in any line of manufacturing activity and 19 reported products valued at less than $5,000 in 1923. (No data are tabulated at the biennial censusses for establishments with products under $5,000 in value.)

The statistics for 1923 and 1921 are summarized in the following statement. The figures for 1923 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

	1923	1921	Per cent of increase[1]
Number of establishments	434	462	—6.1
Wage earners (average number)[2]	5,157	4,682	10.1
Maximum month	Nov. 5,379	Feb. 5,047	....
Minimum month	Jan. 4,917	July 4,124	....
Per cent of maximum	91.4	81.7	....
Wages	$4,892,543	$3,232,984	51.3
Cost of materials (including fuel and containers)	11,808,836	10,807,878	9.3
Products, total value	25,026,557	22,209,476	12.7
Value added by manufacture[3]	13,217,721	11,401,598	15.9
Horsepower	4,878	(4)	....
Coal consumed (tons of 2,000 lbs.)	14,818	(4)	....

[1] A minus sign (—) denotes decrease.
[2] Not including salaried officers and employees nor proprietors and firm members. Statistics for these classes will be given in final report.
[3] Value of products less cost of materials.
[4] Not reported.

New Books

CHEMISTRY IN INDUSTRY. A co-operative work intended to give examples of the contributions made to industry by chemistry. Edited by H. E. Howe, Chairman of the American Chemical Society Committee on Prize Essays; Editor of Industrial and Engineering Chemistry. Published by the Chemical Foundation, Inc., 85 Beaver St., New York, N. Y. Size 5½ x 8 inches VII and 372 pages. Bound in cloth. Price $1.00.

This volume contains a number of essays on the role which chemistry plays in various industries. The collection has been made with the object of familiarizing the general reader with the relations of chemistry to American industry and to present day civilization. The monographs have been prepared by twenty-two leading industrial chemists of this country, the chapter on glass being contributed by Prof. Alexander Silverman of the University of Pittsburgh.

The editor is to be congratulated on having been able to select men who combine literary skill with a thorough knowledge of their specialties. The reader without training in chemistry will find joy as well as instruction in the perusal of its pages. And professional chemists, forced through necessity into narrow specialization, will be grateful for the publication of a book which will aid them to broaden their outlook on their chosen field of work.

OLD GLASS, European and American. By N. Hudson Moore. With 265 unusually fine illustrations from photographs. Cloth, 6½" x 9¾", net $10.00. Published by Frederick A. Stokes Company, 443 Fifth avenue, New York.

This book deals with the development of glass making in Europe and America. As a source book it will prove valuable to collectors looking for an adequate treatment of this subject. Beginning with the early Roman glassmakers, the author relates the progress of glass making as a fine art. The color, composition and workmanship of glass products as manufactured in different countries is minutely described. Not only are the markings and methods of distinguishing genuine old glass fully explained but the book is distinguished by the extraordinary number of illustrations gathered together by the author from museums, private collectors and other sources.

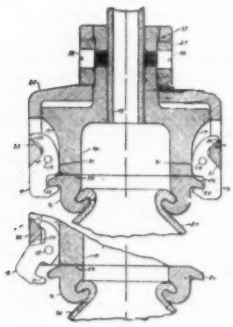
The volume is particularly valuable in its relation to early American glass. The publishers state that to their knowledge, it is the only book that covers the subject.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

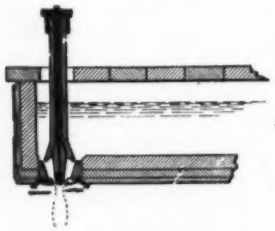
GLASS-DRAWING BAIT AND HOLDER FOR GLASS-DRAWING MACHINES. 1,516,136. Nov. 18, 1924. Hector Bazin, Detroit, Mich. Filed 7/26/23. A bait for drawing glass, comprising a continuous element, sectionally constructed, and a tension or spring member holding said sections in contact with each other and with a glass novel, said element having a novel supporting surface, a recessed groove with inclined sides, and a surface capable of contacting with supporting members on a bait holder, and so constructed as to form in its assembly with the bait holder, a continuous and enclosed passage for the entrance of a compressed medium for blowing glass.



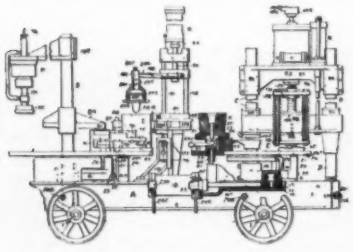
One object of the invention is to permit the drawing of glass under a more uniform temperature by providing an enclosed head or holder surrounding the entrance of the air under pressure.

GLASS FEEDER. 1,512,374. Oct. 21, 1924. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Company. Filed Apr. 6, 1922.

A regulating plunger projecting downward into the glass above the outlet, and adapted to be reciprocated vertically to control the discharge of glass, said plunger having a substantially cylindrical body with a downwardly and outwardly flared enlargement forming at its lower end an annular concave surface surrounding the body of the plunger, the latter being formed with air channels extending upwardly from said surface through the body of the plunger and in communication with the outside air, said surface being formed of a material to which the glass will not adhere, the plunger having a tip projected downward below said surface and formed of refractory material to which the glass will adhere when the tip is heated thereby.



APPARATUS FOR FORMING ARTICLES OF GLASS. 1,515,962. Nov. 18, 1924. Wm. J. Miller, Swissvale, Pa. Filed 10/16/19. New and improved mechanism in duplex table transfer type machines for rotating the parison mold table and the finishing mold table in unison and intermittently. New and improved transfer mechanism for removing the parison from one table to the other, for pressing the parison, and for opening and closing the finishing molds. New and improved fluid pressure mechanism for operating the various portions of the machine in proper synchronization and speed.

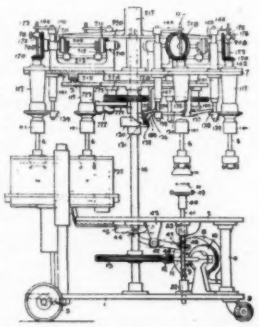


PROCESS FOR THE TREATMENT OF SILICATE COMPOSITION. U. S. 1,497,263. June 10, 1923. Robert L. Frink, Columbus, O. (App. filed June 16, 1919. Ser. No. 304,522.)

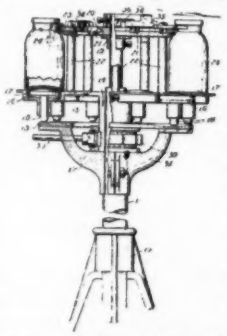
Among the objects are to utilize the waste heat and the chemical constituents of gases issuing from furnaces such as glass furnaces, to produce economically and efficiently alkali metal salts and silicates readily available and in proper proportions for use, particularly in the manufacture of glass.

The process includes forming a silicate for glass manufacture containing calcium, aluminum and alkali metals, and recovering the soluble compounds simultaneously produced which consists in treating clay with salt and a decomposing gas under reacting conditions, treating the resulting silicate with lime in amount sufficient to partially decompose the same leaching the resulting mass, passing carbon dioxide containing gas through the resulting solution, separating the precipitate of alumina produced thereby and concentrating the resulting solution to remove the alkali metal salts therefrom.

MACHINE FOR FINISHING GLASSWARE. 1,515,793. Nov. 18, 1924. Andrew J. Sanford and John B. Townsend, Newark, O., assignors to A. H. Heisey & Co. Filed 3/27/22. Apparatus for fire-polishing and finishing glassware comprising a ware-receiving station, a plurality of fire-polishing stations, a finishing station, and a ware-removing station, a rotable carrier, a plurality of ware-holding snaps carried by said carrier, means for automatically attaching the ware to said snaps at the said ware-receiving station, means for intermittently rotating the said carrier to bring the ware to the said fire-polishing, finishing and ware-discharging stations successively, and means for automatically detaching the said ware from the said snaps at the said ware-removing station.

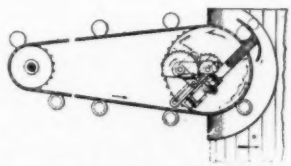


COOLING TRANSFER DEVICE FOR GLASSWARE. 1,518,852. Dec. 9, 1924. Wm. H. Johnson, Terre Haute, Ind., assignor to Automatic Machinery Co. Filed 1/25/23. The inventor claims in a cooling table, the combination of a suitably supported rotatable ware-receiving table arranged to receive the formed ware from the forming machine and provided with a plurality of vertically movable ware-receiving plungers, a corresponding plurality of ware-supporting elements for receiving the ware from the plungers and supporting it until it takes a set, means by which the plungers are automatically raised and lowered to vary the position of the ware relative to the table, and means by which the ware-supporting elements are automatically shifted into and out of ware-supporting position.



CONVEYOR. 1,513,837. Nov. 4, 1924. Garland Lufkin, Sand Springs, Okla., assignor to Alexander H. Kerr, of Sand Springs, Okla. Filed July 21, 1921.

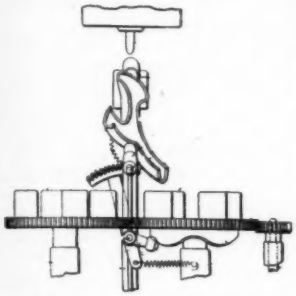
This invention relates to devices for conveying articles of glass from a molding machine into a lehr and distributing the articles onto the lehr pans and includes the combination of a horizontal carrier, a conveyor movable in a curved path over the receiving end of the carrier, an ejector, a crank synchronized with the conveyor and operable to effect a slow movement of the ejector across the receiving end of the carrier in one direction and a quick movement thereof in the



reverse direction, and mechanism for reciprocating the ejector transversely of the path of the conveyor, a predetermined number of times during its slow movement over the carrier.

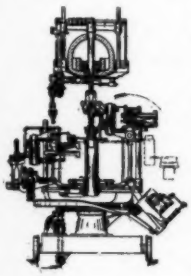
GLASS-DELIVERING APPARATUS. 1,514,526. Nov. 4, 1924. William H. Honiss, Hartford, Conn., assignor to Hartford-Fairmont Company, of Canajoharie, N. Y. Filed Nov. 10, 1921.

One object is to provide for the delivery of mold charges to the molds while the latter are moving, thereby enabling the mold carrying tables to be constantly rotated instead of stopping to receive each successive charge. An important feature is the provision of an inclined trough or transfer member extending from beneath a furnace outlet or charge forming device and having a plurality of outlets through which the charges may be selectively delivered to molds at different receiving stations.

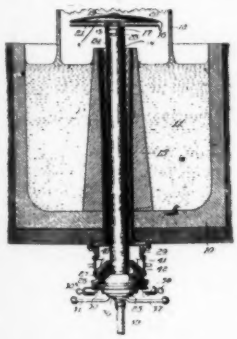


GLASS-FORMING MACHINE. 1,512,372. Oct. 21, 1924. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Company. Filed Apr. 18, 1921.

A glass forming machine, the combination of a continuously rotating mold carriage, a series of parison molds thereon each comprising a neck mold and a body blank mold, finishing molds on the carriage, means to bring the parison molds successively to a charging position at the axis of the mold carriage and hold them in such position while receiving a charge, means to return each charged parison mold, means to open the blank mold leaving the bare parison supported in the neck mold, and means to then close the finishing mold around the parison and blow the latter to finished form.

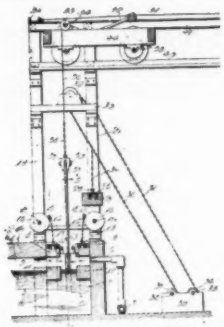


ART OF DRAWING GLASS. 1,518,734. Dec. 9, 1924. R. L. Frink, Lancaster, O. Filed 6/12/23. The method of producing hollow glass articles which consists in drawing a hollow cylinder from a bath of molten glass, subjecting the walls of said cylinder to an internally exerted substantial kinetic thrust applied around said walls below the point of congealing or setting thereof and controlling the force of said thrust to determine the diameter of the cylinder and simultaneously cool the same. In accordance with the present invention a static condition of the air, or any portion thereof, is not purposely maintained, the kinetic effects of a moving current or jet of air being utilized to control and determine the conditions of the drawing process.

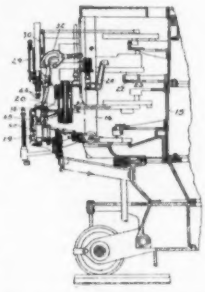


PROCESS IN FROSTING GLASS AND COMPOSITION TO BE USED THEREIN. 1,518,807. Dec. 9, 1924. Clarke C. Minter, New York, N. Y. Filed 5/27/21. A process of frosting glass articles comprising dipping the article to be frosted into a water solution of a silicate having suspended therein finely divided particles of glass to cause a film of said solution having said particles of glass or the like disseminated therethrough to adhere to the surface to be frosted, withdrawing said article from said solution and exposing said article to the air to cause the formation of a solid film from said solution, and then washing said surface with water.

SHEET-GLASS MACHINE. 1,515,625. Nov. 18, 1924. Prentiss M. Sellers, Mount Vernon, O., assignor of one-half to Perry E. Lannoy, Mount Vernon, O. Filed 5/19/21. A fire pot comprising a chamber for receiving melted glass, means for drawing glass out of said chamber in a sheet, and for chilling the side edge portions of the sheet to provide feathered edges while being drawn out of the chamber, means for directing a heat blast across the chamber and removing the lower portion of a sheet of glass being drawn, means for shutting off communication between the auxiliary chamber and main chamber above the glass level, control means for the heat blast to prevent passage of the heat blast across the auxiliary chamber and a removable cover for closing the open upper end of the chamber.

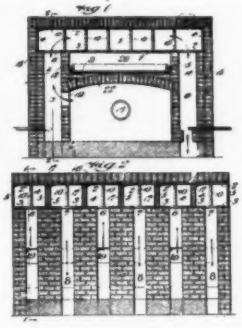


MANUFACTURE OF GLASS CONTAINERS. 1,515,885. Nov. 18, 1924. John F. Rule, Toledo, O., assignor to Owens Bottle Co. Filed 8/14/22. The method of and apparatus for forming a glass bottle for ink and other liquids with separate openings through the neck thereof (one to permit the liquid to be poured out, the other to permit air to enter) which consists in introducing a charge of glass into a mold, forming initial openings in the neck portion of the glass by means of mechanical forming devices within the neck of the mold, withdrawing said forming devices, and supplying pneumatic pressure simultaneously to the openings formed by said forming devices, and causing it to break through the glass between said openings and blow the glass to the form of a bottle.

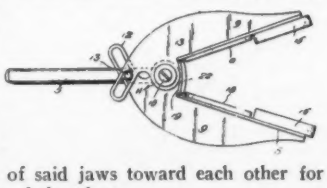


MUFFLE LEHR. 1,517,890. Dec. 2, 1924. Alvie C. Crimmel, Hartford City, Ind. Filed 5/11/23. A plurality of independent removable muffles or muffle units which are so collocated that in case of an explosion or the necessity arising for the removal of any one unit, this can be readily accomplished and a new muffle or unit substituted without disturbing the other muffle units or necessitating the closing down of the lehr, each muffle being composed of a closed top, sides and ends, and a bottom having openings at or near its opposite ends adapted to serve as either inlet or outlet openings for the hot gases, and inlet and outlet flues communicating with said openings.

The muffle units arranged substantially in parallelism and in proximity to each other, each being provided with openings at or near their opposite ends and supported upon the walls of the lehr in such a way that neither the products of combustion nor the flame come in direct contact with the ware in the annealing chamber.



GLASS-HANDLING TONGS. 1,516,844. Nov. 25, 1924. Doston E. Cross, Morgantown, W. Va. Filed 9/22/23. One object of the invention is to provide glass-handling tongs which may be engaged with the glass and utilized for moving the same without requiring the user to deviate materially from his natural standing posture, the device embodying handle members adapted to be pressed together in a natural vertical direction, and cooperatively related with a pair of horizontally movable jaw members whereby such pressing together of the handles will cause movement of said jaws toward each other for firmly engaging opposite sides of the glass.



Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the informationn printed in this department comes direct from the manufacturers of the products described.

New Type of Sand Valve

The control of hot gases from producers and waste heat from coke ovens, ore smelting plants and others of like nature has always been attended with difficulty and uncertainty. For this purpose water cooled valves have been used with more or less success but they are expensive in first cost and maintenance and are a source of danger in case of failure in the water supply.

Valves depending upon the sealing by metal to metal contact have also been used but have never been successful and it is safe to say that they can not be until some metal is discovered which will not warp under the heat or until some sort of refractory substance is found which has sufficient mechanical strength and durability.

MAYERS VERTICAL SAND VALVE

The horizontal sand valves in general use in producer plants today are effective and are practically gas tight when properly operated. They have, however, some serious drawbacks. Those who have operated this type of valve under gas pressure know that it involves a considerable amount of labor under uncomfortable conditions, and that there is often some danger from the ignition of the escaping gas. In order to repair or replenish the sand seal in horizontal valves access may be had only through the clean-out doors or poke holes. This is a troublesome and risky operation, especially when the gas pressure is on the top of the valve plate, as it usually is.

In many installations it has been found necessary to provide vertical runs of pipe just to accommodate the horizontal valves and it is apparent that in ordinary cases the number of available locations for vertical valves far exceeds those for the horizontal type.

In order to overcome the defects and difficulties of operation, as above mentioned, as well as some others not mentioned, the Mayers Vertical Sand Valve has been developed.

The salient feature of this valve is found in the employment of two closing plates instead of one, the intervening space being filled with sand when the valve is closed. These plates do not necessarily make a close fit with the valve seats and they may be considered merely as containers for the diaphragm of sand between them, the sand alone forming the effective seal. The plates are connected at their tops only by a U shape attachment and are held against their seats by the sand pressure.

In cases where the valve is to remain closed for a considerable length of time the sand diaphragm may, after a few days, be removed through the clean-out door at the bottom, after which the seal is maintained by the adhering tar and sand around the valve seats. The clean-out door may then be left open thus providing natural ventilation between the plates for cooling them, or mechanical ventilation may be used if found advisable.

When the valve is to be opened the plates are first jarred loose through the door, the poke holes or from the top opening. They may then be raised quickly by a downward pull upon one or both wire cables and a cover plate inserted in the enlarged opening at the top of the valve body, this plate being finally covered with sand.

The plates are counterweighted to about 70 per cent of their combined weight so that they may be let down by gravity when the valve is to be closed.

These valves may be obtained from H. L. Dixon Company, P. O. Box 140, Pittsburgh, Pa., in sizes up to 84 inches, outside pipe diameter. They are made horizontally split for pipe lines already erected.

"Measuring CO_2 Electrically" is the title of a 16-page copyrighted catalog, No. 32, recently issued by The Brown Instrument Company, 4513 Wayne avenue, Philadelphia, Pa. It discusses the possibilities for greatest economies in steam power plants. Fuel is the greatest expense in power plant operation and too much or too little air supplied for combustion wastes it. The amount of air actually supplied can only be determined from the analyses of the flue gases. The catalog describes the instruments made by the company for measuring the CO_2 in the gases, including the Brown Duplex Continuous Chart Recorder, the Single Record Continuous Chart Recorder, the Circular Chart Recorder, the Combined CO_2 and Flue Gas Temperature Recorder, and Electric CO_2 Indicator. The principle of operation of the electric CO_2 meter is explained. Details are illustrated and a description of a typical installation is given.

The Corning Glass Company, Corning, N Y., has recently placed a contract for the construction of a complete new recuperative day tank. This new tank is to be used in the manufacture of special glass requiring extra high temperatures. It is to be similar in design to the new type recuperative day tank put into operation at the Jefferson Glass Company, Follansbee, W. Va., some time ago. This latter installation it is said has been proven very efficient by utilizing the heat from the waste gases and preheating the incoming air through the medium of a refactory tile recuperator. The preheated air gives an exceptionally high flame temperature with a resulting low fuel consumption. Such operation has been considered ideal by the Corning Glass officials for the special glass which they will make. The Chapman-Stein Furnace Company of Mt. Vernon Ohio, were the engineers and contractors for the Jefferson Glass Company furnace and they also have the contract for the Corning Glass day tank.

The Coshocton Glass Company at Coshocton, Ohio, have also contracted for extensive repairs to their glass tank.

The Glass World and What It Is Doing

News of the Industry

Libbey-Owens Reports Very Profitable Year

The net earnings of the Libbey-Owens Sheet Glass Co. for the fiscal year ended September 30, 1924, show a net profit of $3,274,989 and a surplus of $4,259,157.

In his annual report, submitted December 10, 1924, President Libbey said that the enlarging of six of the twelve furnaces at Charleston to accommodate two machines to each of such furnaces has been completed. There are now installed and operating in that factory a total installation of eighteen glass-drawing machines, compared with the original plant containing six machines.

The power house equipment and water facilities have been increased.

Lumber sheds with a greatly increased storage capacity have been completed. The erection of twenty-five additional houses on the land acquired to the west of the factory site has been completed.

With the exception of some interruptions due to experimental work and regular routine furnace repairs, the plant has operated to capacity.

Title to an undivided one-half interest in the Charleston District gas property which was developed jointly with the Owens Bottle Company was transferred to the Libbey-Owens company during the year.

The experimental department has continued its work on the new grinding and polishing process with the result that added improvements have been effected. Other experimental work was also carried on during the year with satisfactory results.

The grinding and polishing plant mentioned under experimental work in the last annual report should be completed and manufacturing operations started early in 1925. The building, equipment, and machine foundations are designed to accommodate 109 grinding and polishing machines, which will provide a large output of polished plate glass of the best quality.

The demand for glass has required the full operation of the plants of the company and subsidiaries. Every effort has been made to improve quality and to give customers good service. Two price cuts in heavy glass were made during the year, the first on December 27, 1923, and the second on July 1, 1924. A reduction in the price of single and double strength glass was made on August 1, 1924.

Subsidiary companies, the United States Sheet & Window Glass Company and the Fairfield Sheet Glass Company, have shown substantial improvement compared to last year. The shipments from these two plants have been of assistance in enabling taking care of the demand for the Libbey-Owens product.

FOREIGN

The six machine plant of the Compagnie Internationale Pour la Fabrication Mecanique du Verre, at Moll, Belgium, has been in full operation since the middle of last June, at which time the last two machines entered into production. From the start, its product has found a ready market, and continues to be greatly in demand in England and other European countries, South America, Canada, China, and the Near East.

Because of the successful results of the first year of operation, our Belgian associates have decided to double the plant at once and build a plate glass plant, using the grinding and polishing process developed at the Toledo plant.

NEW PLATE GLASS PLANT OF THE LIBBEY-OWENS SHEET GLASS COMPANY, TOLEDO, OHIO

Through the Belgian Company, the development of the Libbey-Owens process in other countries is actively under way and there is every reason to believe that the steady increase in the number of licensees during the last few years will be continued this year.

The America-Japan Sheet Glass Company, in Japan, continues to earn substantial profits and there is every reason to believe that the result of the process in Japan will prove to be very satisfactory.

The product of the one machine plant of the Compagnie Des Verreries de Moutier, at Moutier, near Bale, Switzerland, has established itself in the market, although the present unsettled economic situation in Europe has been a disturbing factor. It is hoped that the condition will change with the re-establishment of more normal conditions, including an adequate tariff.

For reasons given in the last annual report, it continues to be inadvisable to operate the plant of the Canadian Libbey-Owens Sheet Glass Company, Ltd., located at Hamilton, Ont. In the meantime the Compagnie Internationale pour la Fabrication Mecanique du Verre is selling its glass in Canada

through the Canadian Company which acts as agent and receives a commission on all glass sold. The Belgian Company's glass is very well received in Canada and the demand for it continues to increase.

The first plant of the Compagnie Franco-Belge pour la Fabrication Mecanique du Verre is nearly completed. The initial installation located at St. Etienne, France, consists of one tank with two machines and it is expected that glass will be drawn by February, 1925. A second plant, reference to which was made in the last report, is now well under construction. This required an increase in capitalization which was readily subscribed. The plant will consist of two tanks and four machines and is located near Lens in the northern part of France. The decision to build this second and larger plant in France, as well as to build a plant in Italy, was made because of the success of the plant in Belgium.

The continued unsatisfactory political situation in Spain, reference to which was made in the last report, has further delayed the construction of the Spanish plant.

Societa Italian Vetri e Cristalli, the Italian licensee of the parent Belgian Company, was organized last March and a one tank two machine plant is under construction near Venice. Rapid progress is being made in the construction of this plant and it is expected that the manufacture of glass will be commenced next Fall.

Assets

Current Cash—			
On hand	$1,507.80		
On deposit	1,387,071.06		
		$1,388,578.86	
U. S. Government Securities—			
Treasury Certificates	$2,100,000.00		
Liberty Bonds	30,500.00		
Interest accrued	13,339.47		
		2,143,839.47	
Accounts Receivable—			
Customers' accounts, less allowance for doubtful, discounts, etc.		429,228.85	
Inventories—			
Finished glass, raw materials, supplies, etc.		1,204,639.20	
Total current assets			$5,166,286.38
Investments in, and due from controlled and affiliated companies			3,345,516.76
Other Assets—			
Miscellaneous receivables, claims, etc.			97,392.49
Permanent—			
Land, improvements, buildings, Equipment, Gas Properties, etc. (depreciated values)			7,565,193.21
Other Real Estate—			
Land and employes houses (depreciated values)			452,302.02
Patents—			
Depreciated book value			1,154,217.56
Deferred—			
Unexpired insurance premiums, prepaid taxes, etc.			43,554.48
			$17,824,462.90

Liabilities

Current—			
Accounts Payable—			
For purchases, unpaid payrolls, customers' credit balances, unclaimed wages, etc.		$574,937.88	
Accrued—			
Taxes, legal fees, insurance, etc.		39,960.70	
Total current liabilities			$614,898.58
Reserves—			
For equalizing overhead and repairs		$136,593.72	
For federal taxes and contingencies		1,313,812.75	
			1,450,406.47
Capital Stock—			
Preferred 7% cumulative—			
Authorized $5,000,000.00			
Less Unissued... 1,000,000.00			
	$4,000,000.00		
Common—			
Authorized $10,000,000.00			
Less Unissued... 2,500,000.00			
	7,500,000.00		
		$11,500,000.00	
Surplus		4,259,157.85	
			15,759,157.85
			$17,824,462.90

Note: The company was liable at September 30, 1924, for uncompleted construction contracts in the approximate amount of $1,025,000.00, and for the unpaid portion of its subscription for capital stock of an affiliated company.

Income and Expense Statement

Operating profit—after deducting cost of sales and administrative expenses	$3,919,150.68
Other income	486,975.93
Total income	$4,406,126.61
Less—Foreign, patent, licensing, experimental, reconstruction expenses, etc.	538,136.73
Profit before federal tax and contingency provision	$3,867,989.88
Reserve for federal taxes and contingencies (estimated)	593,000.00
Net profit to surplus	$3,274,989.88

Distributors Hold Successful Meeting

The tenth annual meeting of the National Glass Distributors' Association, held at Pittsburgh, December 9 and 10, was probably the most successful get-to-gether assembly of the members ever held. There was a record breaking attendance.

John N. Carey, of Stewart-Carey Glass Company, Indianapolis, Ind., was elected president for the ensuing year, following the very successful administration of E. V. Jacka, the retiring president. W. J. Schoonover, of W. J. Schoonover Glass Company, Scranton, Pa., was elected vice-president. North Storms was re-elected secretary and treasurer.

On Tuesday, December 9, more than 200 members and friends were the guests of the American Window Glass Company, under of guidance of W. L. Munro, president; Arthur Braun, vice-president; George H. Mayer, sales manager, and L. R. Schmertz, general superintendent, on a trip to inspect the company's famous window glass plant at Jeannette, Pa. A special train took the party to Greensburg where they visited the Country Club. An enjoyable luncheon was served, after which the party went immediately to plant No. 2, where they were shown the wonders of glass making by the American type of cylinder drawing machines. This factory has the largest production capacity of any of the company's several plants.

The attention of the visitors was directed to the coal-handling and storage equipment, boiler house, power house, and producer plant, consisting of ten Wellman-Seaver-Morgan producers with automatic feed and mechanical poking devices and capable of gasifying 480 tons of coal every 24 hours, producing the equivalent of 9,600,000 cu. ft. of natural gas a day.

The three melting furnaces, two of them the largest in the world, measuring 140 ft. inside length, 36 ft. 3 in. inside width and 5 ft. in depth, also attracted much attention. Each furnace contains 1,800 tons of molten glass and melts 150 tons of raw materials and 100 tons of cullet every 24 hours, producing 3,240 fifty-foot boxes of single strength glass per day.

Each of the two large furnaces supplies glass to 12 drawing machines and the small furnace has 8 machines, a total of thirty-two. At the large tanks glass cylinders measuring up to 34 in. diameter and 43 ft. long can be drawn.

The flattening house is equipped for flattening by a new process on which patents have been applied for. The box shop has a daily capacity of 8,500 boxes and consumes when running at capacity about 6,000,000 ft. of lumber each day.

After returning to Pittsburgh the distributors became the guests of the Plate Glass Association of America at a dinner and entertainment held at William Penn Hotel on Tuesday evening. H. S. Wherret of the Pittsburgh Plate Glass Company was in charge of the affair which was greatly enjoyed by the guests.

On Wednesday the rolled glass manufacturers entertained the distributors at luncheon at the William Penn Hotel.

The association meeting proved very interesting. An address was made by Capt. C. W. Brown, president of the Pittsburgh Plate Glass Company, who said, regarding probable conditions in the industry in the near future, that it was neither healthful nor reasonable to expect a continuance of such undue prosperity as the industry has enjoyed during the past 10 years, the most prosperous period in its history. Even the general and severe liquidation in 1920 passed over this industry comparatively lightly. But during the past year importations of foreign glass have so increased that American manufacturers have been forced to curtail production greatly. With care and economy, however, the coming year should prove satisfactory.

W. L. Munro, president and general manager of the American Window Glass Company, also gave the members an interesting optimistic talk on future conditions. After discussing the situation he referred to the movement to induce all manufacturers of window glass to place slips in the boxes designating the quality and strength of the glass and stated that it had not met with success, and evoked the approval of the jobbers by stating that his own company would, nevertheless, continue the practice.

Others who addressed the meeting were S. C. Gilmore of Hires-Turner Glass Co., Philadelphia; C. J. Gundlach, of New York, president of the Mississippi Wire Glass Co.; J. Roy Helm, of the Edward Ford Plate Glass Co., Toledo, O.

Flint and Lime Association Golden Jubilee

Exactly fifty years from the date of its birth in the old South Side district, Pittsburgh, a large number of members of the American Association of Flint and Lime Glass Manufacturers met at the Fort Pitt Hotel, Thursday evening, December 11, 1924, took part in an enjoyable banquet and listened to the reminiscences of several of the older members who related the early history of the organization and described its useful career.

Following the dinner, President W. A. B. Dalzell, of the Fostoria Glass Company, addressed the gathering briefly, referring to the good accomplished by the association in various ways and to the fact that its activities have always been conducted in such a manner as to avoid giving annoyance to others. It had never attempted to regulate prices and consequently was never in conflict with the Sherman law. Mr. Dalzell predicted good business for the new year, but warned his hearers that the country will not stand for higher prices and that profits must come from economies and reduction of production costs. He strongly urged every manufacturer who has not already done so to install a cost system that would reveal actual conditions each month and enable the management to detect abnormal costs and take prompt action to control them.

He spoke also of the need of the industry for the application by the Government of the American valuation plan to imports of glass.

Marion G. Bryce, of the United States Glass Company, as toastmaster, introduced Marshall W. Gleason, president of Gleason-Tiebout Glass Company, Brooklyn, was one of the association's eldest and most valued members, whose long services to the association included nearly twenty years as vice-president and nine years as president.

Mr. Gleason, harking back to old times, contrasted conditions then existent with those of today and referred to the great advances made since then in the quality of glass products of all kinds, and in new and useful products, constituting a contribution from the glass industry of genuine importance to the progress of the world.

The importance of the association to the welfare of the glass industry was emphasized by Nicholas Kopp, of the Pittsburgh Lamp, Brass and Glass Company, who spoke of the frequent necessity for concerted action on the part of the manufacturers if the interests of the industry are to be protected and progress maintained. Mr. Kopp spoke of the insufficiency of the present tariff law in regard to glass and, pointing out the impossibility of getting a fair hearing for an industry in the few minutes allowed to its representative before the Senate Tariff Committee, he said the time had come when the tariff question as affecting glass could not be handled satisfactorily by any political party, the industry having become too large and diversified, and that furthermore, the problem is an economic and not a political one.

Joseph Knox Stone addressed the audience on "A Century and a Third of Organization," and a number of others, including C. B. Roe, E. W. Bryce, C. H. West, C. R. Harmon, A. C. Scroggins, Jr., Reuben Haley, George Dougherty and John Kunzler, actuary of the association for many years, also spoke.

American Ceramic Society

Plans for the twenty-seventh annual meeting of the American Ceramic Society, at Columbus, O., February 16 to 21, are going forward. Nine hundred rooms are being held subject to reservation and the Railroad Association has granted a rate of one and a half rail fare on the certificate plan.

Monday, February 16, will be given over to celebrating the thirtieth anniversary of the founding of world's first collegiate department of ceramic engineering of Ohio State University. Tuesday and Wednesday will be devoted to meetings of the seven industrial divisions, with a banquet on Tuesday evening.

The committee on the classification and specifications for feldspar, which has been working on the problem for some months, is expected to make its report at the meeting.

Plant itineraries are being arranged for Thursday, Friday and Saturday, taking in Columbus, Lancaster, Newark and Coshocton.

Big Victory for Glass in Rate Decision

A rate decision recently announced by the Interstate Commerce Commission in the case of the Indian Packing Corporation, National Food Packers' Traffic Association, National Preservers' and Fruit Products' Association, H. J. Heinz Company, Afart & McGuire Company, American Spice Trade Association, and the Glass Container Association of America, against the railroads in Official Classification Territory, is considered one of the most important decisions ever made affecting the interests of glass container manufacturers and is expected to have a far-reaching effect on the industry.

The decision will have the effect of reducing the penalty for shipping in glass the food products it names from approximately 85 per cent to 25 per cent.

It reads as follows:

> "Upon the whole record we find that the less-than-carload ratings in official classification applicable to the interstate transportation of sliced dried beef; olives; mince meat; pickles; table sauces; fish, other than fresh; canned or preserved fruit; fruit butter; crushed fruit; fruit jams; fruit jelly; fruit pulp; edible jams, jellies or preserves; and corn syrup jelly, when in glass, packed in barrels or boxes, are and for the future will be unreasonable to the extent that they are or may be higher than the first numbered class above the less-than-carload ratings contemporaneously applicable to the same articles when in metal cans, packed in barrels or boxes."

A full report of the decision and events leading up to it is given in the December, 1924 issue of *The Glass Container*.

American Industrial Art Exhibition

An exhibition of American industrial art is being held at the Carnegie Institute, Pittsburgh, Pa., and will continue through January 18th.

In the exhibition there is represented current work of many American manufacturers, assembled with the idea of demonstrating the progress of designers in artistic manufactures in the United States. All the objects in the exhibition have been designed and executed in this country within the last two or three years.

Because of the limited space at the institute it has not been possible to show a great number of objects, but a sufficient number have been selected to demonstrate the artistic ability to produce in this country objects of applied art of high type, especially on the basis of "quantity production," which is the only basis calculated to meet the requirements of current life.

The exhibition consists of glassware, pottery, furniture, jewelry, laces and embroideries, metalwork, hardware, lighting fixtures, rugs, silver and goldsmiths' work, tapestries, textiles, leaded glass and wallpaper.

Among the exhibits are many artistically designed and beautifully made pieces of glassware. One entire case is devoted to products made and donated by the Westmoreland Specialty Company, Grapeville, Pa. Another case is filled with glassware and china decorated with deposited gold and silver. Products manufactured by the Corning Glass Company and A. H. Heisey & Company are included, also decorations on glass by Edmondson Warrin, New York, and C. Reizenstein Sons, Pittsburgh.

This exhibition is of particular interest to manufacturers, designers, salesmen, craftsmen, artisans, teachers, homemakers and others practically engaged or actively interested in the industrial arts.

New Beveling and Mirror List

The National Conference of the Mirror Manufacturers Association was held at the William Penn Hotel, Pittsburgh, December 8, 9 and 10. The association authorized the issuance about January 1 of a new price list on beveling and mirrors. Members of the association, together with the members of the National Glass Distributors' Association, were the guests of the Plate Glass Manufacturers' of America at a dinner at the William Penn Hotel on Tuesday evening, December 9. When sending notices to members regarding the conference, H. C. Sorden, secretary, stated that all plate glass manufacturers reported a large volume of business from the mirror industry, and that every indication points to a record business for 1925.

Austin Company Will Purchase Glass

In anticipation of greatly increased activity in the industrial construction field, The Austin Company, industrial builders, with headquarters at Cleveland, O., will begin to place orders for materials to cover 1925 requirements within the next few weeks.

The Austin Company maintains large stocks of building materials at Cleveland, Philadelphia and Chicago.

Some idea of the quantities to be purchased and carried in stock, or purchased locally, in anticipation of partially meeting their requirements for 1925 will be gained from the following figures:

1,600,000 sq. ft. of glass; 700 tons of putty; 43,000 lineal ft. of mechanical sash operating devices; 10,000 tons of steel shapes, plates and bars; 30,000 tons of fabricated structural steel; 22,000,000 feet, BM of lumber; 20,000,000 brick; 200,000 barrels of Portland cement; 60,000 yards of sand; 100,000 yards of stone, slag and gravel; 12,000 sq. ft. of steel rolling doors; 2,500,000 sq. ft. of built-up composition roof waterproofing; 1,400,000 sq. ft. of steel sash; 350,000 sq. ft. of maple flooring; 78,000 sq. ft. of wood doors; 28,000 gallons of paint; 50,000 sq. ft. of wood block flooring; 1,500 tons of metal roofing and siding; 7,000 tons of reinforcing steel; 200,000 sq. ft. of cement tile roofing; 100,000 sq. ft. of gypsum roofing.

It is estimated that approximately 25,000 cars would be required to transport these materials and would make up trains having an aggregate length of approximately 200 miles. Five hundred locomotives would be required to haul these materials with trains made up of 50 cars. The total value of the materials listed would be approximately $7,000,000.

The requirements of The Austin Company can be more readily appreciated when it is realized that the number of construction projects under way at any given time is close to 100, including complete plants, costing over a million dollars, as well as small plant units, in the form of extensions and separate buildings.

Operations are carried on in every industrial section of the United States and Canada. The export business of the company also runs to considerable volume, the company having built plants in nineteen foreign countries, including a complete glass plant, comprised of twelve buildings in Belgium.

The company has been very active in the domestic glass field during 1924, having designed and built complete plants or plant extensions for the Hocking Glass Company, Capstan Glass Company, Whitall-Tatum Company, Indiana Glass Company, Lancaster Glass Company, Findlay Clay Pot Company, Hygeia Nursing Bottle Co. and Southern Glass Co.

G. A. Bryant, Jr., is vice-president of The Austin Company and P. J. Brennan, general purchasing agent.

Libbey Glass Purchases Nonik Corporation

The Libbey Glass Manufacturing Company has announced the purchase recently of the Nonik Glassware Corporation, New York, and is now the sole and exclusive manufacturer and distributor of Nonik glassware, as well as the owner of all patents, trademarks and copyrights in this and foreign countries pertaining to Nonik and Dura glassware.

A large part of the Nonik Corporation sales force has been added to the Libbey force. R. I. Ratner, formerly president of the Nonik Corporation and the Dura Import Company has become officially connected with the Libbey company. His long experience in the hotel, restaurant, and soda fountain glassware field will be utilized in a plan whereby Mr. Ratner and several very able salesmen long associated with Mr. Ratner will devote their time and efforts exclusively to this department.

The "Safedge" principle of the reinforced or protected edge for blown glassware will be applied to the Nonik line. The Libbey company states that the object in combining these features is to place on the market in large volume the only super-strength, chip-resisting blown glassware in existence.

The Libbey Company are opening large headquarters in the Fifth Avenue building, New York, on February 1. R. I. Ratner and Kenneth P. Lockitt will be located in that city. James P. Gordon has become associated with the Libbey Company as Eastern sales representative, excepting New England and the Metropolitan district. The full line is exhibited at the Pittsburgh Show.

Trade Activities

Lafayette Window Glass Company, Clarksburg, W. Va., a hand operated window glass plant, resumed operations late in November.

The Penn Plate and Window Glass Company, Scranton, Pa., has applied for a charter of incorporation in the state of Pennsylvania.

S. Baskowitz & Sons, Inc., 2315 Morgan street, St. Louis, Mo., has been incorporated with a capital of $50,000 to manufacture bottles.

Consumers Glass Company, 2451 Lawrence avenue, Chicago, Ill., has been incorporated with a capital of $5,000 to deal in art glass, mirrors, etc.

D. C. Jenkins Glass Company, Arcadia, Ind., had a break in a large tank on December 11, necessitating a shut-down for a period of several weeks.

Union Paint & Glass Company, Uniontown, Pa., has been incorporated with a capital of $25,000 by E. M. Patterson, David P. Lindsey and Thomas Thomas.

The Gill Brothers Glass Company's plant at Toronto, O., may be taken over by an organization of local citizens of that community, according to reports circulated in the vicinity.

Frank W. Lesch Company, Valparaiso, Ind., has been incorporated to manufacture glassware. The directors are: Frank W. Lesch, Edith McArndt and Joseph L. Thompson.

Turner Brothers Company, Terre Haute, Ind., are installing a new Simplex lehr equipped with conveyors and automatic lehr loader furnished by the Automatic Machinery Company, of Terre Haute.

The Weston Glass Company, Weston, W. Va., met with a heavy loss when a large tank broke on December 13, compelling the closing of the factory for several weeks. The tank is now being rebuilt.

The Corning Glass Works reports that statements to the effect that the Wellsboro plant of the company was to be abandoned are erroneous, and that on the other hand it is now in normal operation

Allegany Window Glass Company's plant at Port Allegany, Pa., was recently sold to satisfy mortgage claims. H. R. Hilton, former secretary of the company, reports that nothing will be done towards reorganization until next spring.

Central Glass Works, Wheeling, W. Va., are planning the erection of an extensive addition to its present plant. It is expected that erection will be started soon after the first of the year so that it can be completed for the spring rush.

The Alley Glass Company, according to newspaper reports, will move its plant from Shinnston, W. Va., to Salem, W. Va., where it will manufacture blanks and continue cutting operations. The company has increased its capital from $10,000 to $50,000.

Edward Danner, inventor of the well-known tube machine, according to reports from Newark, O., sailed recently for Germany to take charge of the installation of another of his inventions, a sheet glass drawing machine, for the Stinnes interests.

York Mirror & Glass Company, York, Pa., has filed application for a Pennsylvania charter. The company will manufacture and sell mirrors, glass products, cabinet hardware, etc., and includes John L. Gerber, Harry G. Selling and George A. Wolf as incorporators.

The Youngsville Mirror Works, Youngsville, N. Y., is the name under which Charles and George Dyer will operate the plant of the Gem Mirror Works which they have leased for five years and which had previously been operated by the Falconer Mirror Works.

Capstan Glass Company, South Connellsville, Pa., is planning the erection of a one and two-story building at an estimated cost of about $150,000, which will provide 100,000 sq. ft. additional floor space. One of the buildings when completed will be used as a machine shop.

H. J. Eckenrode, president of the National Plate Glass Company, Detroit, Mich., recently was given recognition for his efficient services to the company by being elected a director of the Fisher Body Corporation, which controls the National Plate Glass Company, and which in turn is a subsidiary of the General Motors Corporation.

Nelson Perin, of the **Berkeley Glass Sand Company,** Berkeley Springs, W. Va., recently disposed of his interests in that company to Henry P. Bridges, Baltimore, Md., a member of the firm.

J. H. McNash, secretary of the Hazel-Atlas Glass Company, Wheeling, W. Va., who for some time has acted as executive vice-president, was elected at a recent meeting of the board of directors to the presidency of the company, following the resignation of J. C. Brady, now chairman of the board. Mr. McNash began as a clerk with the Hazel-Atlas Company about twenty years ago and his long service, ability and familiarity with the business resulted in his being chosen for the presidency.

The Bartlett-Collins Glass Company, Sapulpa, Okla., at a recent meeting of the board of directors, elected the following officers: H. U. Bartlett, president; D. C. Hamilton, vice-president; J. W. Collins, secretary, and E. E. Bartlett, treasurer and general manager. New machinery, including grinding and glazing apparatus, has been installed, and the plant is at present operating on hot mold tumblers and iced teas. The company has arranged for group insurance of employes and policies have been issued by the Aetna Life Insurance Company.

The Bonita Art Glass Company, whose plant in East Wheeling, W. Va., was recently destroyed by fire, announces that it will not rebuild in that city, but will locate in Huntington, W. Va., where a site and building has been purchased at a cost of about $14,000. It is expected to have the new factory in operation about the first of February. The removal was occasioned by the fact that the company was unable to find a suitable building in Wheeling which could be occupied almost immediately, and it was impossible to construct a new factory in time to resume operations and fill orders to be taken at the glassware exhibit to be held in Pittsburgh during January.

Coming Meetings

AMERICAN CERAMIC SOCIETY annual meeting will be held at Columbus, O., February 16 to 21, 1925, inclusive.

NATIONAL ORNAMENTAL GLASS MANUFACTURERS' ASSOCIATION will hold its annual convention in Pittsburgh, June 24 to 26, 1925.

AMERICAN FLINT GLASS WORKERS' UNION, annual convention will be held the first week of July, 1925, in Toledo, O.

THE EASTERN GLASS DISTRIBUTORS' ASSOCIATION will hold its next meeting at the Hotel McAlpin, New York, on February 18, 1925.

THE ANNUAL GLASS AND POTTERY SHOW will open at the Fort Pitt Hotel, Pittsburgh, on January 5. The display of domestic glassware, lamps, dinner ware, art pottery, etc., will be extensive, many manufacturers having reserved exhibition space.

Recent Deaths

Rudolf G. Sommerfeld, president of the Sommerfeld Machine & Manufacturing Company, Pittsburgh, manufacturers of glass house machinery, died on November 21. Mr. Sommerfeld, who was born in Germany in 1868, came to this country about forty years ago. In 1897 he founded the Sommerfeld Machine & Manufacturing Company. He is survived by his wife, four daughters and three sons, who are also associated with the Sommerfeld Company.

Issac A. Ambler, vice-president and general manager of the Jeannette Glass Company, Jeannette, Pa., died on November 22 after several months illness. Mr. Ambler, who was 38 years of age, became connected with the Jeannette Glass Company several years ago and was instrumental in changing the plant over from the manufacture of bottles to that of tableware. He is survived by his wife, parents and two sisters.

HermanWiedenheft, for over forty years superintendent of the D. O. Cunningham Glass Company, Pittsburgh, died at his home in that city on November 27. He leaves his wife, three daughters and three sons.

William Loeffler, an early glass manufacturer, died at his home in Pittsburgh on November 29. He was born in Germany in 1842, coming to this country at an early age. Mr. Loeffler became a clerk in the office of Robert C. Schmertz glass manufacturer in 1864, later becoming president of that company which was merged with the American Window Glass Company of which Mr. Loeffler became vice-president and a director, retiring in 1903. His wife, two sons and a daughter survive.

Inquiries Received

For Further Information Address THE GLASS INDUSTRY.

237. We desire to obtain a glass grinding mill for grinding glass bowls (Dec. 10).

238. We would like to obtain small glass articles either hand blown or blown into molds for lighting purposes, as follows: hemispherical shaped article 2¾ inches over lip in quantities of 100, and also mushroom shaped articles 1⅞ inches in diameter in lots of 300. (Dec. 12.)

239. Kindly give us a number of names of mirror manufacturers in New York City and vicinity. (Dec. 4.)

240. Kindly inform me where I can obtain a glass rod and tube drawing machine. (Dec. 16.)

241. We would like the names of manufacturers of light amber plate glass. (Dec. 18.)

242. Will you kindly advise the names of concerns making 2 and 3 ounce black glass cold cream jars, particularly with matt acid finish and wide screw necks. (Dec. 22.)

243. Where can we obtain Colemanite? (Dec. 19.)

What the World Wants

Specific inquiries for American goods received in the Department of Commerce.

Numbers prefixed to the items refer to confidential information which may be obtained by concerns listed in the Exporters' Index by applying to the nearest district office of the Bureaus of Foreign and Domestic Commerce, or to headquarters at Washington, D. C. Mention the number of the inquiry in which you are interested.

To become listed on the Exporters' Index, it is necessary to fill out a form (Form 57), which may be had upon application to the Bureau or its district or co-operative offices.

India. 12586, table glassware; 12580, soda ash; 12745, window glass, mirrors and plate glass; 12844, glassware, tumblers, dinner and tea sets, lamps and chimneys.

England. 12786, glassware.

Denmark. 12894, glass rollers for leather-glazing machines.

Australia. 12939, glassware, window plate, fan lights and ordinary window glass.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Union Trust Bldg., Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, DECEMBER 22, 1924

	Bid	Ask	Last
American Window Glass Machine, common	85¾	86¼	86
American Window Glass Machine, preferred	94	95	94
American Window Glass, preferred	109½	110	110
Pittsburgh Plate Glass	256	260	258
U. S. Glass	16	17	17
Standard Plate Glass, common	13½	14	13¾
Standard Plate Glass, preferred:			
Cumulative	75	81	80
Prior	97	99	98

Glass stocks in the Pittsburgh Stock Exchange showed relatively little change in the past month, sales being in moderate volume. Building activity during 1925 is certain to be in substantial volume. So far as present facts give a basis for estimate, it is expected the new year may yield about five billion dollars' worth of new construction. But this compares with an outlay of about six billions for the current year. In fact, we should expect the total volume of construction during 1925 to fall appreciably below that for both 1924 and 1923, and we should not expect the peak of next year's building to register such a high level as was registered in the two former years.

The general trend of building activity is now gradually downward. In October and November the floor space in contracts awarded was much less than in the corresponding months of 1923. In view of the favorable outlook for business in the near future, and the consequent likelihood that there will be at least a moderate Spring expansion in building activity, it is very likely that recent firmness in glass indicates the probability of general stable prices throughout the winter, but no important price changes in early Spring.

WHEELING STOCK EXCHANGE, DECEMBER 22, 1924

	Bid	Ask	Last
Hazel-Atlas	33½	34	34
Imperial	75	86	88
Fostoria	140	..	140
Central	..	108	108

Activity has increased in Wheeling glass securities during December. Orders show some improvement and have been coming in in steady volume.

TOLEDO STOCK EXCHANGE, DECEMBER 22, 1924

	Bid	Ask	Last
Owens Bottle Machine, common	43¾	44¼	44
Libbey-Owens Sheet Glass, common	97	101	100
Libbey-Owens Sheet Glass, preferred	109	111	110

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers.

December 22, 1924		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.05½
Aluminum oxide (Al_2O_3)	lb.	.06½	.07
Antimony oxide (Sb_2O_3)	lb.	..	..
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.06	.06½
Barium carbonate ($BaCO_3$) (precipitated)	ton	63.00	65.00
Barium hydrate ($Ba(OH)_2$)	lb.	.05	.05½
Bone ash	lb.	.06	.06½
Borax ($Na_2B_4O_710H_2O$)	lb.	.04¾	.05
Borax, fused ($Na_2B_4O_7$) any mesh	lb.	.14½	.15½
Boric acid (B_2O_3), fused	lb.	..	.35
Boric acid, refined	lb.	.08½	.09
Cadmium Sulphide (CdS)—			
Red	lb.	..	1.60
Orange	lb.	1.50	1.60
Yellow	lb.	..	1.80
Chrome Oxide (Cr_2O_3)	lb.	.35	.36
Cobalt Oxide (Co_2O_3)—			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide—			
Red (Cu_2O)	lb.	..	.19
Black (CuO)	lb.	..	.25
Black prepared	lb.	..	.30
Cryolite (Na_3AlF_6)	lb.	..	.09⅛
Feldspar—			
100 mesh	ton	14.00	16.00
80 mesh	ton	12.00	..
40 mesh	ton	12.00	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	38.00	..
Hydrofluoric acid (HF) 60% (in lead carboys)	lb.	..	.13
Kaolin (f.o.b. mine)	ton	9.00	12.00
Lead Oxide (Pb_3O_4) (red lead)	lb.	.12¾	.13
Litharge (PbO)	lb.	.12¼	.12½

		Carlots	Less Carlots
Lime—			
Hydrated ($Ca(OH)_2$) (in 50 lb. paper sacks)	ton	11.00-12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls. per bbl.		2.15	2.30
Magnesium carbonate ($MgCO_3$)	lb.	..	.08
Manganese 85% (MnO_2)	lb.	.03¼	.03¾
Nickel oxide (Ni_2O_3), black, for nickel content	lb.	.30	.32½
Nickel monoxide (NiO), green, for nickel content	lb.	.30	.32½
Potassium carbonate—			
Calcined (K_2CO_3) 96%	lb.	.05¾	.06
Hydrated 85%	lb.	.05¾	.06
Potassium nitrate (KNO_3) (gran.)	lb.	.06	.06¼
Potassium permanganate ($KMnO_4$)	lb.	.14½	.16
Powdered blue	lb.	..	.24-26
Standard formula	lb.	..	.32
Salt cake, glassmakers (Na_2SO_4), f.o.b. works	ton	20.00-25.00	22.00-27.00
Selenium (Se)	lb.	..	2.15-2.25
Soda ash (Na_2CO_3) dense, 58%— f.o.b. works.			
Bulk, spot	Flat 100 lb.	1.35-1.40	..
Bulk, on contract	Flat 100 lb.	1.35	..
In 400 lb. bbls., on contract	100 lb.	1.69	2.40
In 400 lb. bags, on contract	100 lb.	1.45	..
Spot orders .05 per 100 lbs. higher.			
Sodium nitrate ($NaNO_3$),			
Refined (gran.) in bbls.	lb.	.04	.04½
95 per cent		.02½	.02⅜
Sodium selenite (Na_2SeO_3)	lb.	..	2.00
Sodium Fluosilicate (Na_2SiF_6)	lb.	..	.07½
Sulphur (S)—			
Flowers, 155 lb. bbl.	Per 100 lb.	3.35	3.65-3.90
Flowers, in bags	Per 100 lb.	3.00	3.30-3.55
Flour, heavy, in bbls.	Per 100 lb.	2.40	3.30-3.55
Uranium oxide (UO_3), 100 lb. lots	lb.	..	1.25
Zinc oxide (ZnO)	lb.	.08	.08¼

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to November 24, 1924

	October 1923 Quantity	October 1923 Value	October 1924 Quantity	October 1924 Value	Ten Months Ending October 1923 Quantity	Ten Months Ending October 1923 Value	Ten Months Ending October 1924 Quantity	Ten Months Ending October 1924 Value
Glass and glass products (total)	.....	$904,125	.....	$763,018	.....	$9,183,786	.....	$7,329,927
Plate and window glass—								
Window glass, common, box 50 sq. ft.	2,500	$15,171	2,421	$13,815	36,309	$201,404	31,251	$145,459
Plate glass, unsilvered, sq. ft.	76,191	51,596	46,633	22,421	1,767,330	765,063	1,445,060	436,436
Other windows and plate glass, n.e.s. lbs.	241,728	20,273	201,481	22,463	2,998,046	334,771	1,704,295	190,576
Glass containers (bottles, vials and jars) lbs.	6,141,814	287,910	5,341,788	264,627	62,715,207	2,975,130	51,054,250	2,425,536
Table glassware, plain lbs.	1,794,834	178,745	1,746,175	168,741	17,000,161	1,859,553	13,873,806	1,500,061
Table and other glassware, cut or engraved lbs.	37,711	20,018	62,149	19,032	470,774	180,874	437,442	134,225
Glass for lighting—								
Lamp chimneys and lantern globes lbs.	154,279	32,119	108,019	21,323	1,644,973	323,037	1,608,896	300,390
Globes and shades for lighting fixtures lbs.	195,624	51,775	146,312	37,799	1,282,827	386,826	1,094,925	327,689
Lamps and other illuminating devices, chiefly of glass lbs.	121,778	34,128	73,979	18,918	1,281,020	331,781	836,366	239,950
Chemical glassware lbs.	35,780	19,922	33,441	22,827	205,938	143,566	201,645	162,759
Electrical glassware, except for lighting lbs.	95,467	13,238	231,082	15,672	2,301,360	154,115	2,142,702	207,808
Other glassware, n.e.s. lbs.	870,133	179,730	646,768	135,380	8,624,374	1,527,666	7,402,389	1,259,038

IMPORTS

Corrected to November 24, 1924

Glass (total)	.....	$2,696,578	.....	$1,575,780	.....	$20,895,213	.....	$16,643,776
Cylinder, crown and sheet lbs.—								
Unpolished, lbs. dut.	2,772,170	$149,845	1,543,294	$84,685	41,554,803	$1,833,550	26,560,352	$1,518,662
Bent, ground, leveled, colored, painted, etc., and polished dut.	.....	62,695	.....	38,903	.....	670,448	.....	417,167
Plate glass—								
Unsilvered, sq. ft. dut.	2,737,447	1,831,230	1,144,599	639,610	22,317,942	13,474,964	14,808,514	8,948,961
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft. dut.	161,901	30,188	147,920	30,015	1,893,172	321,746	2,275,437	313,324
Containers—bottles, vials, etc. dut.	.....	6,219	.....	20,455	.....	175,325	.....	176,872
Table and kitchen utensils, lbs. dut.	179,907	35,159	55,831	16,884	522,557	133,148	747,440	166,502
Glassware, cut or decorated, lbs. dut.	431,235	174,615	511,479	235,887	3,041,501	1,175,673	3,325,845	1,568,336
Blown glassware, n. e. s., lbs. dut.	847,413	215,992	.....	.....	5,477,818	1,184,093	.....	.....
Bottles, ornaments, etc., lbs. dut.	.....	.....	1,081,573	274,187	.....	.....	5,280,837	1,551,969
Bulbs or electric lamps, number dut.	.....	.....	1,428,860	17,544	.....	.....	12,447,567	185,072
Chimneys, globes, shades, etc., lbs. dut.	.....	.....	346,544	87,129	.....	.....	3,900,931	731,634
Articles and utensils for chemical, scientific, and experimental purposes, lbs. dut.	.....	.....	109,912	35,223	.....	.....	839,989	289,864
Other glassware { free / dut.	.....	190,635	.....	95,258	.....	1,926,266	.....	775,413